



National Aeronautics and Space Administration

Academy of Program/Project & Engineering Leadership

Project Management and Systems Engineering Competency Framework



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INTRODUCTION

Strengthening NASA's project management capability has been central to the mission of the Academy of Program/Project & Engineering Leadership (APPEL) since its inception more than fifteen years ago. Following the recommendations of the Rogers Commission after the 1986 *Challenger* accident, NASA created the Academy to develop an agency-wide professional development program for project management.

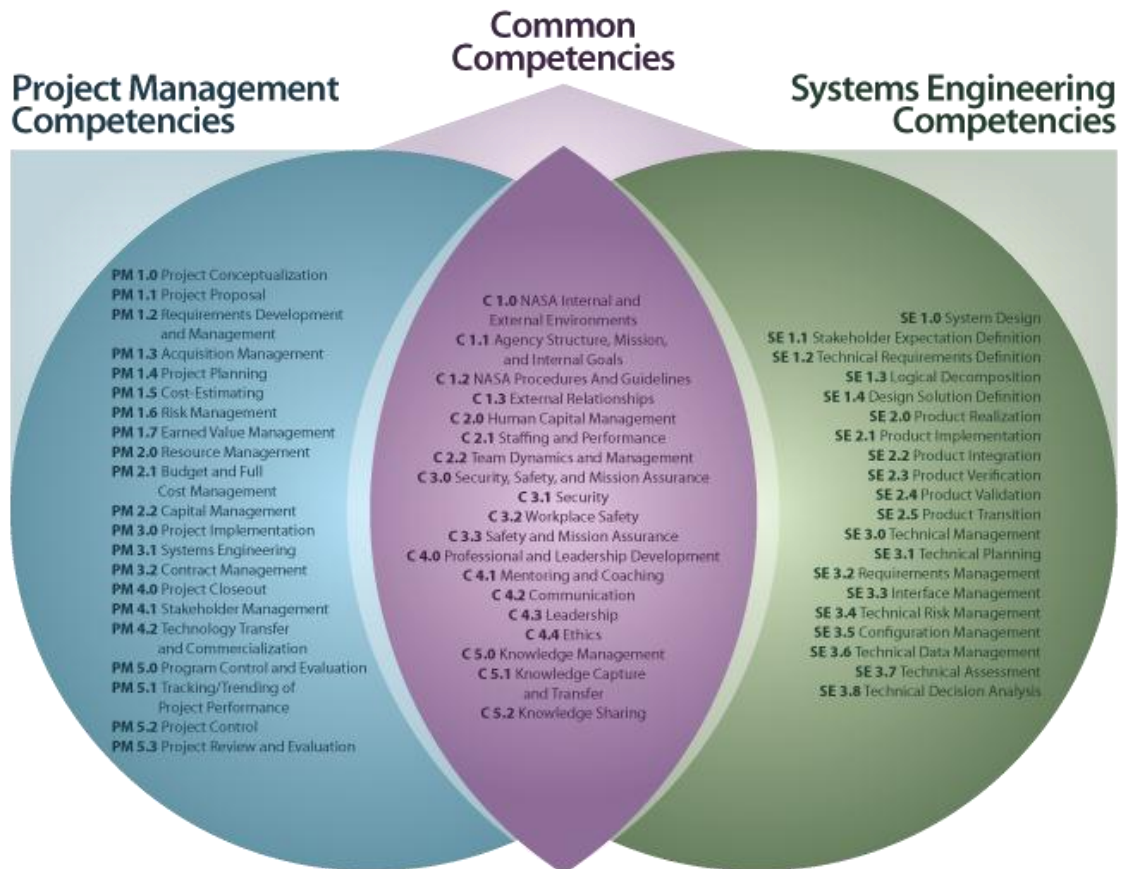
From its beginning, the Academy focused on building a competency model for project management that would serve as the foundation for all of its offerings. Every Academy training course, project team intervention, and knowledge sharing activity has a direct relationship to at least one NASA project management competency. This document offers a detailed description of the skills, behaviors, actions, and experiences that demonstrate proficiency in each competency at four career levels, ranging from project team members to managers of programs or very large projects.

METHODOLOGY

The Academy developed the NASA project management competency model through a multi-step collaborative process. It first derived its requirements based on extensive interviews with highly successful NASA project managers and systems engineers. It then incorporated input gathered through the DACUM (Developing a Curriculum) methodology and practitioner focus groups. After devising a draft competency model, the Academy validated it with internal and external organizations that reviewed it for both thoroughness and accuracy. Validation also included aligning it with NASA policies and procedures as well as existing project manager competency models at NASA field centers and leading external organizations. Once validation was complete, the Academy created performance-level descriptions to guide the overall development of individuals through each phase of their careers.

OVERVIEW OF COMPETENCY MODEL

The NASA project management and systems engineering competency framework consists of five project management competency areas, three systems engineering competency areas, and five competency areas common to both disciplines.



This document provides a detailed description of each of the areas identified above, including the specific actions necessary to demonstrate competency as an individual progresses through his or her career.

NASA PROJECT MANAGEMENT AND SYSTEMS ENGINEERING COMPETENCIES

Detailed Project Management Competencies

PM 1.0 Project Conceptualization

- [PM 1.1 Project Proposal](#)
- [PM 1.2 Requirements Development and Management](#)
- [PM 1.3 Acquisition Management](#)
- [PM 1.4 Project Planning](#)
- [PM 1.5 Cost-Estimating](#)
- [PM 1.6 Risk Management](#)
- [PM 1.7 Earned Value Management \(EVM\)](#)

PM2.0 Resource Management

- [PM 2.1 Budget and Full Cost Management](#)
- [PM 2.2 Capital Management](#)

PM3.0 Project Implementation

- [PM 3.1 Systems Engineering \(see SE Competencies\)](#)
- [PM 3.2 Contract Management](#)

PM4.0 Project Closeout

- [PM 4.1 Stakeholder Management](#)
- [PM 4.2 Technology Transfer and Commercialization](#)

PM 5.0 Program Control and Evaluation

- [PM 5.1 Tracking/Trending of Project Performance](#)
- [PM 5.2 Project Control](#)
- [PM 5.3 Project Review and Evaluation](#)

Detailed Systems Engineering Competencies

SE 1.0 System Design

- [SE 1.1 Stakeholder Expectation Definition & Management](#)
- [SE 1.2 Technical Requirements Definition](#)
- [SE 1.3 Logical Decomposition](#)
- [SE 1.4 Design Solution Definition](#)

SE 2.0 Product Realization

- [SE 2.1 Product Implementation](#)
- [SE 2.2 Product Integration](#)
- [SE 2.3 Product Verification](#)
- [SE 2.4 Product Validation](#)
- [SE 2.5 Product Transition](#)

SE 3.0 Technical Management

- [SE 3.1 Technical Planning](#)
- [SE 3.2 Requirements Management](#)
- [SE 3.3 Interface Management](#)

[SE 3.4 Technical Risk Management](#)
[SE 3.5 Configuration Management](#)
[SE 3.6 Technical Data Management](#)
[SE 3.7 Technical Assessment](#)
[SE 3.8 Technical Decision Analysis](#)

Detailed Common Management Competencies

C 1.0 NASA Internal & External Environments

[C 1.1 Agency Structure, Mission, and Internal Goals](#)
[C 1.2 NASA Procedures and Guidelines](#)
[C 1.3 External Relationships](#)

C 2.0 Human Capital Management

[C 2.1 Staffing and Performance](#)
[C 2.2 Team Dynamics and Management](#)

C 3.0 Security, Safety, and Mission Assurance

[C 3.1 Security](#)
[C 3.2 Workplace Safety](#)
[C 3.3 Safety and Mission Assurance](#)

C 4.0 Professional and Leadership Development

[C 4.1 Mentoring and Coaching](#)
[C 4.2 Communication](#)
[C 4.3 Leadership](#)
[C 4.4 Ethics](#)

C 5.0 Knowledge Management

[C 5.1 Knowledge Capture and Transfer](#)
[C 5.2 Knowledge Sharing](#)

PROJECT MANAGEMENT COMPETENCIES

PM 1.0 PROJECT CONCEPTUALIZATION

Project Conceptualization is the development of a concept, overall plan, and proposal for a successful NASA project. It encompasses the skills needed to conceive of a project in its entirety, from initial planning through resource allocation, establishment of project requirements, and credible cost and risk assessment consistent with the NASA vision, strategies, and objectives. Competency in **Project Conceptualization** assures expertise across a diverse range of skill sets, and highlights the project manager's ability to think broadly and conceptually while performing at a high level of technical proficiency.

There are seven aspects (sub-competencies) of **Project Conceptualization**:

- PM 1.1 Project Proposal
- PM 1.2 Requirements Development and Management
- PM 1.3 Acquisition Management
- PM 1.4 Project Planning
- PM 1.5 Cost Estimating
- PM 1.6 Risk Management
- PM 1.7 Earned Value Management (EVM)

Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

PM 1.1 Project Proposal

The **Project Proposal** sub-competency addresses the skills utilized to create a winning project proposal. Individuals must demonstrate the ability to conceive of the project, analyze its potential value, and define the plans and requirements necessary to ensure success. Technical expertise is needed to write, manage, and submit a winning proposal. Depending upon the role of the individual, the proficiency levels achieved in the **Project Proposal** sub-competency are as follows:

Project Team Member

Individuals should be *aware of* industry partnering activity and NASA infrastructure utilization, and participate in developing functional, physical, and operational architectures, including life-cycle costing. They should be *able to* describe, identify, or define the following:

- How NASA projects are proposed, approved and funded
- The basic elements of a successful project proposal
- How a current project's proposal meets the needs of a NASA Strategic Plan element and the Center Implementation Plan;;;

Project Team Members must **support** activities involving multiple organizations outside the center, and develop a network of external contacts.

Subsystem Lead/Manager

Subsystem Lead/Managers must **participate** in a range of activities, such as developing functional, physical, and operational architectures (including life-cycle costing); and developing, costing, and trading concepts, along with their technology plans. They should pursue activities involving multiple organizations outside the center to expand their network of external contacts, as well as industry partnering activities and NASA infrastructure utilization. They should be knowledgeable about the steps of the center's bid and proposal process, such as submitting a project for consideration.

In addition, the Subsystem Lead/Manager must **contribute to** or lead the effort in managing the proposal writing and/or submission process. They should also **develop capability** related to developing, costing and trading concepts, along with their technology plans.

Project Manager

Project Managers should be able to **demonstrate** a) expertise in writing, managing and submitting winning proposals; b) the capacity to develop functional, physical, and operational architectures, including life cycle costing; and c) proficiency in developing, trading, and selecting concepts, along with their technology plans.

Project Managers should also be able to **effectively use** bid and proposal support resources to lead the development of complete bid and proposal packages, and should **support** industry partnering activity and NASA infrastructure utilization. They must also participate significantly in activities involving multiple organizations inside and outside the center, enabled by a network of external contacts.

Program Manager

Program Managers demonstrate competency at an advanced level. Furthermore, they must exhibit a range of skills, including the ability to a) **review** and **approve** bid and proposal packages; b) **direct** the development of functional, physical, and operational architectures (including life-cycle costing), and trading concepts along with their technology plans; c) **identify** industry partnering opportunities and NASA infrastructure utilization; and d) **partner** in the development of appropriate domestic and international partnerships.

PM 1.2 Requirements Development and Management

The **Requirements Development and Management** sub-competency highlights the disciplines involved in developing project requirements. Individuals must be able to use functional analysis, decomposition, and allocation; be capable of finalizing requirements into the baseline; and be able to manage requirements so that changes are minimal. This sub-competency also covers defining, developing, verifying, reviewing and managing changes to program requirements. Depending upon the role of the individual, the

proficiency levels achieved in the ***Requirements Development and Management*** sub-competency are as follows:

Project Team Member

Project Team Members must ***understand*** the process involved in defining requirements, concepts, project plans, and associated items. This starts by ***understanding*** the process of development and iteration of technical requirements, including stakeholder acceptance, and includes analyzing and challenging impacts, capturing relevant standards and criteria, and ensuring each requirement is verifiable. Project Team Members should be ***able to*** describe, identify or define the following:

- The need for customer involvement in order to understand their objectives, plans, and requirements
- The process of decomposing customer requirements into project requirements that are clear, feasible, and verifiable
- Requirements baselining, traceability, change process, and allocation

Subsystem Lead/Manager

Subsystem Lead/Managers ***participate in*** defining requirements, concepts, project plans (baselining, traceability, change process, allocation) and associated items. They also participate in requirements change control for the subsystem and balance requirements changes with subsystem cost and schedule.

Other needed skills include the capacity to ***select and/or tailor*** appropriate requirements, development, and management processes according to project type (e.g., flight, research & technology development); and the ability to ***define, verify, review and maintain*** requirements and specifications through functional analysis, technology feasibility, availability, readiness and decomposition from top-level goals. Subsystem Lead/Managers should also demonstrate expertise in ***tracing*** an assigned system/subsystem product to a specific requirement in the project specification.

Project Manager

Project Managers must be ***able to*** describe, identify or define the following processes:

- Obtaining and evaluating customer functional and performance project requirements and obtain stakeholder acceptance
- Defining, developing, verifying, reviewing and maintaining specifications
- Selecting and/or tailoring appropriate requirements, development, and management processes according to project type (e.g., flight, research & technology development)

In addition, Project Managers must effectively ***manage*** others in requirements development tasks such as functional analysis, analysis of technology feasibility, availability, readiness and decomposition. They should be able to ***select and tailor*** appropriate processes according to project type, and are responsible for ***approving*** project requirements and changes.

Program Manager

Program Managers participate at the highest level. They should be **able to** describe, identify, develop, or define the following:

- Programmatic requirements for obtaining and evaluating customer functional and performance requirements and their management
- The processes for defining, developing, verifying, reviewing, and managing changes to program requirements

In addition, they must **manage** development and iteration of requirements concepts, project plans, the planning, programming, and budgeting execution (PPBE) cycle, and associated items for a project or large sub-system including stakeholder acceptance. This includes analyzing and challenging impacts; capturing relevant standards and criteria; and ensuring each requirement is verifiable. Program Managers are also responsible for **directing** the requirements baselining process, traceability, change process, and allocation, and **approving** program requirements and changes.

PM 1.3 Acquisition Management

Acquisition Management covers the skills required for the development, implementation, and monitoring of a range of activities: acquisition strategies, procurement processes, contract activities, and approval requirements. These skills are developed to support flight hardware/software or other project requirements. Depending upon the role of the individual, the proficiency levels achieved in the **Acquisition Management** sub-competency are as follows:

Project Team Member

Project Team Members must **understand** and fully comply with federal requirements for contracting via “other than full and open competition” (e.g., 8(a), small business, veteran-owned). Project Team Members should **be aware of** the process for the development and implementation of contracts and procurement of flight hardware/software or other project requirements, specifically: statements of work (SOW), data requirement descriptions (DRDs), verification plans, technical metrics, acceptance and approval requirements, the attainment process, and available acquisition instruments and their uses, such as contracts, grants, and cooperative agreements. Furthermore, Project Team Members should be **able to** describe, identify or define the following:

- The purpose and key elements of an acquisition strategy
- Requirements for acquisitions involving well-known, commonly available products, materials, services
- The general acquisition strategy outline of the current project(s)
- The NASA procurement process of obtaining products and services from outside of NASA
- Determining the applicability of EVM for NASA programs/projects and contracts and associated requirements

Project Team Members must also be able to **write** clear SOW, requirements, and specifications that accurately describe the services and products contractors are obligated to provide, and to **prepare** an accurate purchase order for products or services from outside of NASA.

Subsystem Lead/Manager

Subsystem Lead/Managers must a) **contribute** to the development, implementation and monitoring of acquisition strategies, contract SOW, DRDs, verification plans, and approval requirements to support flight hardware/software or other project requirements; b) **establish** effective partnerships with acquisition/contract, EVM and resources management personnel; c) **formulate** and **execute** acquisitions consistent with attainment strategies for projects with low to moderate complexity; d) **perform** project acquisitions for projects with relatively straightforward and stable funding situations; e) **monitor** and **evaluate** the performance of acquisitions with low to moderate complexity; f) **initiate** and **track** procurement processes for needed services and/or products.

Subsystem Lead/Managers should also **serve on** a source evaluation board (SEB) or as a contracting officer's technical representative (COTR) and have experience with the development and implementation of contracts, procurement of major hardware/ software and be able to **employ** the key elements of successful win-win negotiation practices in the management of vendor/contractor relationships.

Project Manager

Project Managers must be **able to** identify the following:

- Strengths, weaknesses, opportunities and risks associated with various acquisition strategies
- Agency and center acquisition procedures and processes
- EVM applicability and implementation requirements and use of EVM
- Requirements for acquisitions involving, advanced, newly developed and innovative products, materials, and services

Project Managers should also possess the ability to: a) **manage** the development and approval of a project's acquisition strategy; b) **establish** and **manage** successful win-win vendor/contractor relationships; c) **establish** effective partnerships with acquisition/contract, EVM, and resources management personnel; d) **demonstrate** capability in development, implementation and monitoring acquisition strategies, contract SOW, DRDs, verification plans, and approval requirements to support flight hardware/software; and e) **apply** and **use** NASA's procurement process and contract relationships. They must also be capable of **formulating** and **executing** acquisitions consistent with attainment strategies for large-scale, complex projects, and of **managing** the development of contract SOW requirements, contractor DRDs, and data types (data approval requirements).

Program Manager

Program Managers are required to a) **approve** and **oversee** a program's acquisition strategy; b) **lead** activities associated with development and implementation of contracts and procurement of major hardware/software when serving on a SEB or as a COTR; c) **direct** development, implementation, and monitoring of acquisition strategies, contract SOW, DRDs, verification plans, and approval requirements to support flight hardware/software; d) **perform** project acquisitions involving multiple contracts, grants, cooperative agreements and other complex funding mechanisms; and e) **monitor** and **evaluate** the performance of acquisitions on large-scale, complex projects using EVM if applicable. Program or Project Managers are also expected to **protect** the interests of NASA when acquiring products, materials, and services in situations involving complex negotiations/agreement.

PM 1.4 Project Planning

Project Planning emphasizes the ability to develop effective project management plans, and the technical integration of project elements for small, moderate, or complex projects. This includes scope definition as well as schedule and resource estimation and allocation for all project phase activities, from concept to launch and tracking. Depending upon the role of the individual, the proficiency levels achieved in the **Project Planning** sub-competency are as follows:

Project Team Member

Project Team Members must **understand** the project/technical integration of project elements, design functions and discipline functions, and their associated interactions to balance performance, cost, reliability, operability, and risk, as well as project formulation activities that include planning for EVM in-house implementation when applicable. They should also be **able to** describe, identify or define the following:

- The overall NASA project life-cycle, and specific steps in the cycle (e.g., milestone reviews) and project life-cycle and gate products
- How to use scheduling and cost estimating tools to plan the design, development, and testing activities
- How to develop a work breakdown structure (WBS) and associated schedule

Project Team Members should **participate** in project formulation activities and development of a life-cycle project plan including WBS, budget, schedule, staffing, and project success criteria, and **contribute** to the development of the project WBS. They should also have the skills to **create** the schedule including the steps, linkages, and interfaces of an assigned task for a specific work breakdown structure element.

Subsystem Lead/Manager

Subsystem Lead/Managers should **understand** center and agency budget processes as well as the entire lifecycle review process, and be **able to** plan for milestone reviews. They must be **able to** describe, identify or define the planning process at the subsystem level, including:

- Scope definition

- Integrating activities into a schedule
- Resources estimation and allocation

Subsystem Lead/Managers are also expected to **manage** a small project subsystem or equivalent entity during formulation phase, or other significant involvement in project formulation (with sole authority for project budget, schedule, and scope), and to **participate** in project/technical integration of project elements, design functions and discipline functions, and their associated interactions to balance performance, cost, reliability, operability, and risk. Other needed skills include the ability to a) **develop project plans** for simple, relatively routine, small- to moderate-sized projects, including EVM when applicable; b) **integrate** plans, schedules, and cost estimates for a subsystem; c) **obtain** project approvals through well-established means (e.g., in own work unit); and d) **assure** that resources and schedule are commensurate with the project scope.

Project Manager

Project Managers must be **able to** lead the planning process for a large project subsystem or equivalent entity, including:

- Scope definition
- Integrating activities into schedule
- Resources estimation/allocation
- Typical management controls for area of responsibility
- EVM implementation planning and use when applicable

Project Managers should demonstrate the ability to **manage** a large project subsystem or equivalent entity during formulation phase (with sole authority for project budget, schedule, and scope). This encompasses the **development** and **approval** of the overall project plan including integrated schedule and resource requirements and allocation.

Project Managers are also expected to **use** advanced project planning and tracking tools with extensive EVM capabilities, and to **demonstrate** capability in a) the development of a life-cycle project plan including WBS, budget, schedule, staffing, and project success criteria; b) project/technical integration of project elements, design functions and discipline functions, and their associated interactions to balance performance, cost, schedule, reliability, operability and risk; and c) planning for milestone reviews.

Project Managers are expected to **be** project advocates.

Program Manager

Program Managers are expected to **create** project (and resource) plans for complex projects with many interrelated paths, involving multiple organizational units or contractors, and especially challenging deadlines as well as for projects that are novel, complex, or highly interrelated with other work. They must also **manage** a) the development and approval of the overall program plan, and b) a large project, major system, or equivalent entity during formulation phase (with sole authority for project budget, schedule, and scope). They should be able to **direct** technical integration of project elements, design functions and discipline functions, and their associated

interactions to balance performance, cost, schedule, reliability, and operability as well as the development of a life-cycle project plan including WBS, budget, schedule, staffing, EVM if applicable, and project success criteria. Finally, they are responsible for **obtaining** approval for especially innovative or complex projects that involve multiple funding sources and work interrelationships with other units.

PM 1.5 Cost Estimating

Cost Estimating focuses on financial management skills, including the ability to: develop credible cost estimates to support a variety of systems engineering trade studies; perform affordability analyses; execute strategic planning; participate in capital investment decision making; and prepare budgets during project planning. The capacity to provide information for independent assessments is also required. Depending upon the role of the individual, the proficiency levels achieved in the **Cost Estimating** sub-competency are as follows:

Project Team Member

Project Team Members must **understand** basic cost estimating processes.

Subsystem Lead/Manager

Subsystem Lead/Managers must be **able to ensure**:

- Use of straightforward and well-documented models and techniques for cost estimating during relevant project life-cycle phases
- All project needs are adequately covered and properly time-phased in the budget submission for projects of low to medium complexity
- The cost estimate covers the entire project life-cycle

Project Manager

Project Managers should be able to **use** cost estimates as a planning tool and as an additional input or constraint into the design space for the project. They must also **ensure** the use of advanced models and techniques for cost estimating during relevant project life cycle phases, and **assure** that a cost analysis data requirement (CADRe) is developed and maintained.

Program Manager

Program Managers should be **able to** evaluate and reconcile independent cost estimates with advocacy cost estimates, and must **ensure** that all project needs are adequately covered and properly time phased in the budget submission for large-scale complex projects and/or projects with resource issues.

PM 1.6 Risk Management

Risk Management entails an individual's ability to identify and analyze risk and its impact; develop and implement strategies for risk mitigation; track risk; and implement continuous risk management plans. It also involves communicating risk information to

all project/program levels. Depending upon the role of the individual, the proficiency levels achieved in the **Risk Management** sub-competency are as follows:

Project Team Member

Project Team Members must be **able to** describe, identify or define the following:

- The fundamental concept of continuous risk management (CRM)
- The NASA process of continuous risk management (CRM)
- The connection between identified risk mitigation strategies and the project's plan, schedule, and Estimate At Complete (EAC)
- Risk management process
- The integrated baseline review (IBR) role in the risk management process when EVM is required for projects/contracts
- Techniques to assess, mitigate, and balance risks
- Project management tools and their capabilities with respect to risk management
- Utilization of risk analysis to support decision making

In addition, Project Team Members must **participate in** identifying risks of a project subsystem or element as well as risk management planning and control with respect to technical cost. They should also be able to **identify** and **evaluate** obvious or easy-to-detect technical, schedule, cost and programmatic risks.

Subsystem Lead/Manager

Subsystem Lead/Managers should be **able to** a) develop and implement strategies to mitigate or eliminate risk; b) evaluate risk management products and understand their implications to the system of interest; and c) use techniques to assess, mitigate, and balance risks. They must also **create** and **implement** a risk management/mitigation plan for a subsystem, which involves using failure modes and effects analysis, fault tree analysis, probabilistic risk assessment, or other suitable risk analysis techniques as appropriate. Other needed skills include the demonstrated ability to **participate in** a risk management process that includes IBRs when EVM is required and use risk analysis to support decision making and to **avoid** working on risk issues in isolation. Instead, Subsystem Lead/Managers should access the entire project team, stakeholders, and outside resources as necessary in anticipating and responding to risk issues. Finally, they should be able to **manage** and **communicate** risk data to all potential stakeholders via an integrated system (e.g., the integrated risk management application, or IRMA).

Project Manager

Project Managers are expected to **participate** in risk management planning and control with respect to technical, cost and schedule performance; **manage** the development of and **approve** the project risk management plan; **implement** a continuous risk management plan that supports informed, timely, and effective decisions to control and mitigate risk throughout the project life cycle; and **lead** a risk management process that includes conducting IBRs when EVM is required and utilization of risk analysis to support decision making.

They should also be able to **lead** a risk analysis meeting, in which a collection of risks is:

- Evaluated for impact, probability, and timeframe
- Classified/categorized into risk areas for applying mitigation strategies collectively
- Prioritized to identify the risks most important to the project

Throughout, they must *anticipate* difficult-to-detect technical, schedule, cost, and programmatic risks and then *adjust* plans to overcome these risks.

Program Manager

Program Managers are required at this level to a) *approve* the risk management plan for a program; b) *implement* continuous risk management in a program and its projects to reduce risk; c) *lead* development and execution of CRM planning; d) *direct* project risk management and control with respect to technical, cost and schedule performance, including conduct of IBRs on in-house projects when EVM is required; e) *direct* a risk management process and utilization of risk analysis to support decision making; and f) *monitor* the risk management processes and be able to make adjustments and improvements to ensure effectiveness.

PM 1.7 Earned Value Management (EVM) *EVM* is a tool for measuring and assessing project performance through the integration of technical scope with schedule and cost objectives during the execution of the project. EVM provides quantification of technical progress, enabling management to gain insight into project status and project completion costs and schedules. Two essential characteristics of successful EVM are EVM system data integrity and carefully targeted monthly EVM data analyses (e.g., identification of risky WBS elements). Planning for EVM is essential to effective EVM implementation. EVM entails an individual's ability to: identify and develop EVM requirements for applicable major acquisitions (in-house and contract); develop effective EVM Implementation Plans for projects with EVM requirements; and establish, assess and maintain the project Performance Measurement Baseline (PMB). Depending upon the role of the individual, the proficiency levels achieved in the *EVM* sub-competency are as follows:

Project Team Member

Project Team Members must be *able to* describe, identify or define the following:

- Basic concept of EVM and EVM terminology
- NASA's policy/procedures for applying EVM to major acquisitions
- NASA EVM capability (people, processes, tools, training)
- Process for implementing EVM on projects/contracts and establishing/maintaining the PMB
- IBR processes, including purpose, approach, requirements, roles/responsibilities
- Analyzing EVM data and utilization of EVM analysis to support decision making and development of estimates of cost and schedule at complete

In addition, Project Team Members are expected to **contribute** to implementing the NASA EVM capability on their projects/contracts, identifying appropriate tailoring of the EVM capability/preparing the EVM Implementation Plan for their project and accomplishing the planning necessary to establish the PMB. They should also be able to **identify** and **assign** appropriate performance measurement techniques to work packages to provide meaningful performance measurement data.

Subsystem Lead/Manager

Subsystem Lead/Managers should be **able to** a) **ensure** control account planning captures all the authorized scope, schedule and budget prior to approval by the Project Manager; b) **negotiate** with line management for the assignment of project Control Account Managers (P-CAMs) and other resources; c) **oversee** the initiation and approval of Work Authorization Documents (WADs); d) **review** Change Request Documents, and **approve** those Change Request Documents not requiring Project Manager approval; e) **ensure** all Variance Analysis Reports (VARs) are complete/accurate and have valid corrective actions; and f) **assist** in the development of estimates at completion. Other needed skills include demonstrated ability to **participate** in and/or **lead** IBRs for major acquisitions that require EVM. Finally, they should be able to **manage** and **communicate** project/contract technical, schedule and cost performance status and forecast to the Project Manager using EVM data from the internal EVM system.

Project Manager

Project Managers are expected to a) **ensure** the project EVM system is effectively implemented and maintained and the data from the EVMS is reliable; b) **approve** control account planning guidelines and documentation such as Work Authorization Documents (WADs), management reserve, baseline change requests, estimates at completion (EACs), VARs, etc., for in-house EVM implementation as appropriate; b) **negotiate** with line management for the assignment of Subsystem Lead/Managers; c) support the coordination and conduct of the project IBR by the program manager/customer and **lead** IBRs as appropriate; d) **ensure** project schedule margin is reasonable and controlled; e) **approve** CPR for submittal to senior management and the sponsor; f) **use** the EVM data and performance metrics to **manage** and **control** cost, schedule and technical performance; and g) **communicate** status, impacts and plan of actions to the Program Manager/sponsor.

Program Manager

Program Managers must be **able to** describe, identify or define processes and techniques for effectively managing and controlling projects using EVM. They must demonstrate the capability to a) **apply** EVM requirements to projects/contracts; b) **approve** project plans that include the EVM Implementation Plan; c) **monitor** project performance using EVM data and analysis; and d) **direct** and **approve** changes to the project baseline in a timely manner.

PM 2.0 RESOURCE MANAGEMENT

Resource Management focuses on managing budgets and funding, including overall planning, allocation, and management of program/project resources. Advocacy; budget and operating plan development and management; allocation of financial, facility and other resources; tracking and control of contractor performance using EVM or comparable approaches are also central to this competency area. There are two sub-competencies within **Resource Management**: ***budget and full cost management*** and ***capital management***. Individuals demonstrating competency in this area should be accomplished in both of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

PM 2.1 Budget and Full Cost Management

Budget and Full Cost Management covers the skills needed to execute agency and field center budgeting processes for annual planning, programming, budgeting, and execution (PPBE) and life-cycle budget projections, ensuring consistency between resource availability and project resource needs. This skill set encompasses the ability to manage resources in terms of staffing, facilities, equipment, and budgetary issues. Depending upon the role of the individual, the proficiency levels achieved in the **Budget and Full Cost Management** sub-competency are as follows:

Project Team Member

Project Team Members should ***understand*** the project budget development process as well as NASA's budgeting process and accounting and financial management techniques. They must be ***able to*** describe, identify, or define the following:

- Processes for estimating the cost of technical work products
- General principles of full cost and EVM and their application in the project environment
- Significant resource needs and issues for the system of interest

Project Team Members are expected to ***perform*** cost estimating on technical work products; ***contribute*** to developing products required for the PPBE processes—including timely and accurate full cost budget information (such as labor, procurement, travel estimates) to project managers when requested and recording of project budget activities in NASA's accounting and financial systems; and ***use*** the WBS as a tool for tracking actual versus estimated costs, using this information to revise cost models appropriately.

Subsystem Lead/Manager

Subsystem Lead/Managers must be able to ***review*** and ***approve*** cost estimates for subsystem elements and ***successfully advocate*** for the resources needed to accomplish subsystem work scope. They must ***contribute*** timely and accurate data (such as budget estimates) to project managers per the Planning, Programming, Budgeting and Execution (PPBE) cycle as well as to the project budget development process.

Subsystem Lead/Managers should also be able to a) ***evaluate*** resource management products and understand their implications for the system of interest; b) ***prepare*** a project plan that projects the cost required to proceed according to the project management plan (PMP); c) ***make tradeoffs*** between multiple and competing needs and issues both internal

and external; d) ***negotiate*** budgets and contracts with line organizations or contractors; and e) ***understand*** the process and administer contracts.

Project Manager

Project Managers must demonstrate a range of skills, including the capacity to a) ***apply*** NASA's budgeting process and accounting and financial management techniques and systems to project activities; b) ***lead*** budget development and iteration with the PPBE for a subsystem, small project, or equivalent entity; c) ***evaluate*** the effectiveness of others in performing cost estimating and full cost accounting; d) ***use*** data and information from full cost accounting systems and EVM systems when applicable to make decisions regarding resource allocations; e) ***approve*** the annual comprehensive estimate at completion (EAC) on projects/contracts with EVM in support of the PPBE process; f) ***successfully advocate*** for the resources needed to accomplish project work scope; g) ***contribute*** timely and accurate data and analysis to program and field center managers per the PPBE cycle; and h) ***manage*** budgets and contracts with line organizations or contractors.

Program Manager

Program Managers should be ***able to*** describe, identify or define processes and techniques for working with stakeholders to effectively deal with a dynamic budget environment. They must be able to ***make tradeoffs*** between multiple and competing needs and issues, both internal and external.

Program Managers should demonstrate the capacity to ***manage*** the following: a) budgets and contracts with line organizations or contractors; b) the application of NASA's budgeting process and accounting and financial management techniques; c) the development and iteration of the PPBE for a large project; and d) budget development and iteration with the PPBE for a large project. This should be done while ensuring accuracy of budget activities in NASA's accounting, financial and EVM systems for a large project.

In addition, Program Managers are expected to: ***use*** data and information from full cost accounting systems to make resource allocations throughout the program; ***successfully advocate*** to NASA headquarters (HQ) and field center management for resources; and ***contribute*** timely and accurate data to HQ and field center management per the PPBE cycle.

PM 2.2 Capital Management

Capital Management focuses on expertise in allocating, tracking, and managing funding and other capital resources within a project element, project or program. Depending upon the role of the individual, the proficiency levels achieved in the ***Capital Management*** sub-competency are as follows:

Project Team Member

Project Team Members must ***understand*** the process for allocating, tracking and managing funding and other capital resources within a project.

Subsystem Lead/Manager

Subsystem Lead/Managers must *be familiar with processes to* allocate, track, and manage funding and other capital resources within a project element.

Project Manager

Project Managers should be *able to* apply the processes of allocating, tracking, and managing funding and other capital resources within a project.

Program Manager

Program Managers must be able to *manage* the allocation and tracking of funding and other capital resources within a project.

PM 3.0 PROJECT IMPLEMENTATION

Project Implementation focuses on managing the systems involved in realizing a project. It is the overall process of project initiation and implementation. The sub-competencies for **Project Implementation** are systems engineering and *contract management*. Individuals demonstrating competency in this area should be accomplished in these disciplines. However, the specific expression of their proficiency varies depending upon their role.

PM 3.1 Systems Engineering (see [Systems Engineering Competencies](#) beginning at 6.0)

PM 3.2 Contract Management

Contract Management entails performing acquisition management and monitoring contractor activities to ensure hardware/software components are delivered on time at projected costs, and meet all performance requirements. This sub-competency also involves performing variance reporting and change control functions. Depending upon the role of the individual, the proficiency levels achieved in Contract Management are as follows:

Project Team Member

Project Team Members must *be aware of* the penetration/insight required for contractor activities. They should *understand* configuration or change control process as well as contract performance including EVM if applicable, variance reporting, and contract award recommendation. Project Team Members should be *able to* describe, identify or define the importance of contract surveillance and the different methods that can be employed, and must *demonstrate* implementation of contract surveillance activities such as attending progress reviews, reviewing submittals, and performing EVM system/data surveillance when EVM is required.

Subsystem Lead/Manager

Subsystem Lead/Managers are expected to have *supported* development of penetration/insight processes required for contractor activities based upon risk

assessment. They should also be *experienced* with contract change control, contract performance, variance reporting, and contract award recommendation.

Subsystem Lead/Managers must be able to *apply* the wide array of contract management activities including surveillance, negotiated change orders, and contract close out. In addition, they should know how to *collaborate* with project management and procurement personnel on contract management planning; *perform* contract surveillance activities including knowledge of contractor and their EVM system and monitoring contractors work products; and *evaluate* and *make recommendations* to project management on contract change orders.

Project Manager

Project Managers should be *experienced* in developing penetration/insight processes required for contractor activities based upon risk assessment. They must also *understand* how to manage others in the development of surveillance approaches, negotiate contract provisions, and control of contract changes.

Project Managers should be able to *manage* the wide array of contract management activities, including the acquisition approach and how to optimally select appropriate methods to assure contract terms are met. They are also expected to a) *demonstrate* capability for project contract management including change control, monitoring of contract performance including EVM if applicable, variance reporting, performing EVM system/data surveillance when EVM is required, and contract award recommendation; b) *collaborate* with procurement personnel on acquisition strategies and contract management planning; c) *successfully negotiate* contracts; d) *manage* contract surveillance activities; and e) *evaluate* contractor progress and approve contract changes.

Program Manager

Program Managers must be *able to* describe, identify or define 1) the wide array of contract management activities, including EVM if applicable, and 2) how to optimally select appropriate contract types to enable the development and delivery of project products. They are also expected to excel at the following: a) *developing* penetration/insight processes required for contractor activities based upon risk assessment; b) *chairing* contract change control boards for projects; c) *managing* contract performance evaluation and award recommendation; d) *directing* and *approving* program and project level acquisition strategies; and e) *overseeing* contract management of large contracts.

PM 4.0 PROJECT CLOSEOUT

Project Closeout focuses on managing different aspects of interpersonal relationships and communication. This involves the overall planning and management of project closeout activities, including assessment of project completion, political and other pertinent factors, and stakeholder agreements. Individuals demonstrating competency in

this area should be accomplished in all of these aspects. However, the specific expression of their proficiency varies depending upon their role.

PM 4.1 Stakeholder Management

Stakeholder Management includes identifying, soliciting, executing, and planning interrelationships with those individuals and organizations that are actively involved in the project, who exert influence over the project and its results, or whose interests may be positively or negatively affected as a result of project execution or completion. Depending upon the role of the individual, the proficiency levels achieved in the Stakeholder Management sub-competency are as follows:

Project Team Member

Project Team Members should *be aware* of: a) stakeholder involvement and communication; b) implementation requirements management; c) political, economic, and other factors that influence project goals; and d) external advocacy needs of the project. They must also be *able to* describe, identify or define the following:

- Definition of a stakeholder
- Stakeholders for the project

Subsystem Lead/Manager

Subsystem Lead/Managers must be *able to* describe, identify or define the role of stakeholders in project execution, and the need for communication and agreements with them. They are also expected to *perform* stakeholder communication as appropriate, and *support* stakeholder involvement and implementation requirements management. They are expected to *engage in* the following: a) assessing impacts of political, economic and other factors on project goals; b) external advocacy for an initiative; and c) outreach and education of stakeholders.

Subsystem Lead/Managers should also *contribute to* a) developing and maintaining stakeholder communication and assessing both internal and external influences on the project; b) stakeholder management planning and communications (i.e., outreach, status reports, and requirements management); and c) agreements between the project and its stakeholders (i.e. deliverables both to and from).

Project Manager

Project Managers should be *experienced* in assessing impacts of political, economic, and other factors on project goals. They must be *able to* describe, identify or define:

- The role of stakeholders in project execution
- Examples of involving stakeholders and managing system requirements
- Experience in assessing impacts of political, economic, and other factors on project goals
- Effective methods to communicate and reach agreements with stakeholders

Project Managers are expected to ***engage in*** external advocacy for an initiative and outreach and education of stakeholders; ***direct*** and/or author stakeholder management planning and communications (i.e., outreach, status reports and requirements management); ***perform*** stakeholder communication; and ***arrange*** and ***approve*** agreements between the project and its stakeholders (i.e., deliverables to and from both).

Program Manager

Program Managers should be ***experienced*** with establishing domestic and international relationships, with consideration for the impacts of political, economic, and other factors on program goals. They must be ***able to*** describe, identify or define the following:

- The role of stakeholders in program execution
- Effective methods to communicate and reach agreements with stakeholders

In addition, Program Managers are expected to: a) ***direct*** the process of ***developing and maintaining*** stakeholder communication throughout the project life-cycle; b) ***direct*** and ***implement*** external advocacy for an initiative as well as outreach and education of stakeholders; c) ***direct*** and/or ***author*** program stakeholder management planning and communications (i.e., outreach, status reports, and requirements management). These individuals are also responsible for ***arranging*** and ***approving*** agreements between the program and its stakeholders (i.e., deliverables to and from both).

PM 4.2 Technology Transfer and Commercialization

Technology Transfer and Communication includes evaluating the feasibility, development, progression, readiness, cost, risk, and benefits of new technologies so they can be developed and transferred efficiently and effectively to project stakeholders or possible commercial applications. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Project Team Member

Project Team Members must be ***able to*** describe, identify or define the following:

- Technology readiness levels and how they relate to the system of interest
- NASA's technology transfer and commercialization policies and applications
- Processes for technology assessment
- Technology transfer and commercialization processes

Project Team Members are expected to ***participate in*** project technology assessments as well as technology transfer and/or commercialization activities.

Subsystem Lead/Manager

Subsystem Lead/Managers must be able to ***apply*** the following:

- Processes for leading and reporting results of technology assessment activities
- Processes of technology development and maturation related to technology readiness level (TRL)

- NASA's technology transfer and commercialization policies and applications

They should be *able to* formulate technology development strategies to fill technology gaps as well as to *understand* and *develop* fallback plans and strategies, using existing technology if the new technology is not available.

Subsystem Lead/Managers are expected to *participate in* a) technology development planning for the project and b) technology transfer and/or commercialization activities (which they might be called upon to lead). They must also *lead* and *report* results of technology assessment activities for related subsystems; *establish* TRL progression plans for subsystem elements; and *capitalize on* potentially valuable commercially available technology.

Project Manager

Project Managers should be *experienced* with NASA's technology transfer and commercialization policies and applications. They must be able to *manage* the following:

- Processes for assessing and developing project technologies
- Processes of technology transfer and commercialization and the role of other field center organizations in those processes (such as legal and commercial)

Other needed skills include the ability to a) *direct* and/or *author* technology assessment, development and transfer project plans; b) *evaluate* and *approve* technology maturation progress and assignment of TRL values; c) *arrange* and *direct* technology transfer and/or commercialization activities; and d) *creatively leverage* partnerships and collaborations to use commercial technologies or develop new technologies to meet their center's technology needs.

Program Manager

Program Managers are expected to be *experienced* in motivating implementation of NASA's technology transfer and commercialization policies. They must be *able to* describe, identify or define processes for assessing, developing, and transferring technology.

Program Managers are required to *direct* and/or *author* technology assessment, development, and transfer program plans, as well as to *participate* as necessary in technology transfer and commercialization activities.

PM 5.0 PROJECT CONTROL AND EVALUATION

Project Control and Evaluation addresses skills involved in managing project status and performance. There are three main components to **Project Control and Evaluation**: *tracking/trending of project performance*, *project control*, and *internal and external project review and evaluation*. Individuals demonstrating competency in this area should

be accomplished in all three of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

PM 5.1 Tracking/Trending of Project Performance

Tracking/Trending of Project Performance involves monitoring and evaluating performance metrics, project risks, and earned value data to analyze, assess and report the status and technical performance of a program. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Project Team Member

Project Team Members must be **able to** describe, identify or define the following:

- Collaborative work commitments (CWCs) and strategic planning agreements (SPAs)
- EVM metrics for project and contract performance management
- Maintenance/monitoring of performance metrics, project risk, and earned value data to determine project health status
- Project reporting and evaluation of technical performance metrics, earned value, and risk management analysis

Project Team Members are expected to **support** the maintenance of a decision log containing rationale for major decisions made during the project life-cycle.

Subsystem Lead/Manager

Subsystem Lead/Managers must be able to **support** EVM methods for project and contract performance management, **maintain/monitor** performance metrics, project risk, and earned value data to determine project health status, and **participate in** the development of element-level CWCs and SPAs as well as project monitoring and formal reviews. In addition, they should **contribute to** the following:

- The maintenance of a decision log, at the element level, containing rationale for major decisions made during the project life-cycle
- Project reporting and evaluation of technical performance metrics, earned value, and risk management analysis

Project Manager

Project Managers should be **experienced in** the following:

- Maintaining a decision log containing rationale for major decisions made during the project life cycle
- Developing CWCs and SPAs
- Assuming a leadership role in project reporting and evaluation of technical performance metrics, earned value, and risk management analysis

They are also expected to **lead** comprehensive maintenance/monitoring of performance metrics, project risk, and earned value data to determine project health status; **lead in**

project reporting and evaluation of technical performance metrics, earned value, and risk management analysis; **apply** EVM methods to project and contract management; and **conduct** continual project monitoring and formal reviews.

Program Manager

Program Managers must be able to **implement** EVM for program/project and contract management; **conduct** continual project monitoring and formal reviews; and **maintain** a decision log containing rationale for major decisions made during the project life-cycle. They should also have experience in developing strategy for CWCs and SPAs.

In addition, Program Managers are expected to **manage** the following: a) maintenance/monitoring or performance metrics, project risk, and earned value data to determine project health status, and b) project reporting and evaluation of technical performance metrics, earned value, and risk management analysis.

PM 5.2 Project Control

Project Control focuses on the performance of technical and programmatic activities to control cost, schedule, and technical content and configuration in order to ensure that the project's performance is within approved baseline and to address performance variances. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Project Team Member

Project Team Members must be **able to** describe, identify or define the following:

- The purpose of project control
- Processes for using tracking and trend data to analyze programmatic and technical performance with associated mitigation efforts to address performance variances
- Configuration or change control processes
- EVM process that complies with the ANSI/EIA-748 EVMS guidelines
- Reserve and margin policies and practices
- Scheduling methods such as critical path analysis
- NASA Program Management Council (PMC) or other reporting requirements when project plan cannot be met

Other responsibilities of Project Team Members include a) **participating** in applying program control techniques, including EVM, data management, and configuration management; b) **supporting** configuration control board activities for design/development changes in work elements; c) **developing** baseline cost, schedule and earned value (where appropriate) projections for work elements; and d) **establishing** and **managing configurations** for relatively straightforward products (e.g., small number of uses and users, simple documentation and data control requirements, simple user training requirements).

Subsystem Lead/Manager

Subsystem Lead/Managers must demonstrate *experience* in a) applying program control techniques, including EVM, data management, and configuration management; b) contract change control; and c) applying tracking and trend data to analyze programmatic and technical performance with associated mitigation efforts to address performance variances.

They should be *able to* describe, identify or define the following:

- Responsibilities of configuration control boards (CCB)
- Application of cost reporting and earned value management for multiple project elements
- Schedule integration of multiple project elements
- The processes required to implement corrective actions in areas that deviate from baseline

Subsystem Lead/Managers are also expected to a) *contribute* to project control planning; b) *support* reserve and margin assessment activity as well as CCB activities for design/development changes in subsystem elements; c) *be involved* with PMC and other reporting when project plans cannot be met; d) *collect, collate (i.e., roll up)*, and *report* on applicable cost, schedule, and earned value control metrics; and e) *implement* the corrective actions for their tasks as directed by the Project Manager.

Project Manager

Project Managers must be *experienced in* developing the penetration/insight required to monitor project and contractor activities based upon risk assessment. They should also be *able to* describe, identify or define concepts and techniques for controlling cost, schedule, technical content and configuration, and their application project wide.

They are expected to *perform* critical project control tasks such as reviewing EVM reports, approving cost and schedule changes, and leading a CCB; and to *apply* reserve and margin policy involved in resulting decisions. In addition, they should be able to *direct* and/or *author* project control planning as well as the corrective actions for project areas that deviate from baseline.

Project Managers must *demonstrate* leadership in the following areas:

- Applying tracking and trend data to analyze programmatic and technical performance
 - Developing, evaluating, and implementing mitigation efforts to address performance variances
 - Responsibility for PMC and other reporting when project plan cannot be met
- Finally, they should successfully *manage* configurations with relatively concentrated developmental activity (e.g., small number of persons at one site).

Program Manager

Program Managers must **perform** critical project control tasks such as reviewing EVM reports, approving program costs and schedule changes.

They are expected to **direct** a range of activities, including:

- The corrective actions for program areas that deviate from project plans
- The application of tracking and trend data to analyze programmatic and technical performance
- Development, evaluation, and implementation of mitigation efforts to address performance variances

Program Managers must also a) **tailor** reserve and margin policy and **manage** its application; b) **be responsible** for PMC reporting when a project plan cannot be met; c) **ensure** that adequate controls are implemented, such as program control techniques, including EVM, data management, and configuration management; d) **chair** contract change control board for project; and e) **establish** and **manage** configurations for complex products (e.g., many diverse uses and users, complicated documentation and data control requirements, complex user training requirements with more sophisticated training tools).

PM 5.3 Project Review and Evaluation

Project Review and Evaluation encompasses the planning, conducting, and managing of internal and external project programmatic and technical reviews. This includes the use of metrics to monitor and track the status of the project. Depending upon the role of the individual, the proficiency levels achieved in the **Project Review and Evaluation** sub-competency are as follows:

Project Team Member

Project Team Members must be **able to** describe, identify or define the following:

- The purpose and value of internal and external project reviews
- The review and approval process of technical and programmatic activity
- Tools that objectively measure how much work has been accomplished on a program/ project, and that relate resource planning to technical, cost, and schedule requirements
- Techniques for presenting technical and programmatic information

They should **use** EVM and/or other tools to measure, evaluate, and provide input to progress reviews on specific aspects of the project; **participate** in internal project peer reviews as both presenter and reviewer; and **work** with the convening authority to ensure technical reviews occur at the proper project level of maturity.

Subsystem Lead/Manager

Subsystem Lead/Managers must *participate in* the review and approval process for a technical and programmatic activity. They should be *able to* describe, identify or define how to plan and conduct subsystem portions of both internal and external project reviews.

Subsystem Lead/Managers are expected to do the following: a) *prepare* programmatic and technical subsystem development performance for project management's use in external reviews; b) *present* subsystem development performance at major milestone reviews such as Preliminary Design Review (PDR) and Critical Design Review (CDR); c) *plan* and *manage* internal peer reviews for subsystems; and d) *manage* the process of addressing the findings of review panels/boards.

Project Manager

Project Managers are expected to exhibit *significant participation* or *leadership* of an element of the review and approval process for a technical and programmatic activity. They must be able to *manage* all facets of preparing and conducting internal and external reviews. They are required to *approve* and *manage* the continuum of internal and external project reviews; *document* and *present* project progress in terms of resources, technical, and schedule accomplishments to the program office, PMC and at reviews such as PDR, CDR, Standing Review Boards (SRB), etc.; and *recognize* the need for and *initiate* additional reviews (e.g., peer reviews).

Program Manager

Program Managers are responsible for the *management* of a project/program through a review and approval process. They must be able to *direct* personnel on how to structure and formulate reviews to the major stakeholders at the highest level of agency management, academia, and industry. In addition, they should *conduct* major project reviews for the stakeholders of the governing Program Management Council (PMC), and SRB, independent assessment, or other high-level review teams, including those from academia and industry.

SYSTEMS ENGINEERING COMPETENCIES

SE 1.0 SYSTEM DESIGN

Project Conceptualization includes developing stakeholder expectations, defining technical requirements, performing logical decomposition, and defining design solutions to result in a validated set of requirements and a validated design solution that satisfies a set of stakeholder expectations.

There are four aspects (sub-competencies) of **System Design**:

- SE 1.1 Stakeholder Expectation Definition & Management
- SE 1.2 Technical Requirements Definition
- SE 1.3 Logical Decomposition
- SE 1.4 Design Solution Definition

Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

SE 1.1 Stakeholder Expectation Definition & Management

Stakeholder Expectation Definition & Management addresses the ability to elicit and define the stakeholder's expectations through the use of cases, scenarios, and operational concepts. Individuals must demonstrate the ability to identify the stakeholders and establish support strategies for them. Setting measures of effectiveness (MOEs), validating stakeholder expectation statements, and obtaining commitments from the customer and other stakeholders must also be successfully executed. Depending upon the role of the individual, the proficiency levels achieved in the ***Stakeholder Expectation Definition & Management*** sub-competency are as follows:

Technical Engineer/Project Team Member

Individuals should be ***aware*** that stakeholders must be involved early on in the project life-cycle. They should ***contribute to*** a) the translation of stakeholder expectations into acceptable statements; b) the creation of MOEs from stakeholder expectation statements; c) the validation of stakeholder expectations statements; and d) baselining of stakeholder expectations.

In addition, a technical engineer/project team member must be ***aware*** of obtaining stakeholder buy-in and that stakeholder's expectations must be managed throughout the project life-cycle.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads must be ***able to*** identify project stakeholders and ***contribute to*** obtaining stakeholder expectations and obtaining stakeholder buy-in of validated expectations.

They must be ***able to*** do the following:

- translate stakeholder expectations into acceptable statements
- create MOEs from stakeholder expectation statements
- validate stakeholder expectations statements
- baseline stakeholder expectations

A Subsystem Lead will also ***participate in*** management of stakeholders expectations throughout the project life-cycle.

Project Systems Engineer

A Project Systems Engineer must be *able to* do the following for a system:

- identify project stakeholders
- obtain stakeholder buy-in of validated expectations
- manage stakeholders' expectations throughout the project lifecycle

In addition, they must also show competency in *directing* the acquisition of stakeholder expectations and translating them into acceptable statements. Once translated, the engineer will create MOEs from these previously translated statements. The Project Systems Engineer is also responsible for the *direction* of stakeholder expectation statement validation and baselining.

Program Systems Engineer

The Program Systems Engineer is responsible for identifying program stakeholders. For a program, they should be *able to* obtain stakeholder buy-in of validated expectations and manage these expectations throughout the project life-cycle.

The Program Systems Engineer must also be able to *direct* the following for a program: a) the acquisition of stakeholder expectations; b) translation of stakeholder expectations into acceptable statements; c) creation of MOEs from stakeholder expectation statements; d) validation of stakeholder expectations statements; and e) generation of base-lined stakeholder expectations.

Finally, the Program Systems Engineer has the responsibility to *define* the agency or center stakeholder expectation management policies.

SE 1.2 Technical Requirements Definition

This sub-competency addresses the ability to transform baselined stakeholder expectations into unique, quantitative, and measureable technical requirements. Such requirements are expressed as “shall” statements that can be used for defining the design solution. This process includes analyzing the scope of the technical effort, defining the constraints affecting the designs, defining the functional and behavioral expectations in technical terms, defining the performance requirements, validating the resulting technical requirement statements, defining the measures of performance (MOPs) for each MOE, and defining the appropriate technical performance measures (TPMs) by which technical progress will be assessed. Proficiency in the *Technical Requirements Definition* is achieved in the following areas for the appropriate role:

Technical Engineer/Project Team Member

A Technical Engineer/Project Team Member must be *aware* that the design cannot begin until the technical scope of the project has been defined and that the design and product constraints of the project will impact the finished product.

The Technical Engineer/Project Team Member is also responsible for *contributing to* the following functions: a) converting functional and behavioral expectations into technical

terms with performance requirements; b) expressing technical requirements in an acceptable form; c) defining the MOPs and TPMs; d) validating the requirements; and e) developing the specification document.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads must be *aware of* new technology developments. They must be *able to* achieve the following:

- Convert functional and behavioral expectations into technical terms with performance requirements
- Express technical requirements in an acceptable form
- Define MOPs and TPMs
- Validate requirements

A Subsystem Lead will also *contribute to* the definition of the technical problem scope as well as the design and product constraints. Lastly, they must also *contribute to* the development of specification documents.

Project Systems Engineer

Individuals must be *aware of* technological developments. They must be *able to* define the technical problem scope, and design and product constraints for a system.

For a system, they must also demonstrate competency in the *direction of*:

- Conversion of functional and behavioral expectations into technical terms with performance requirements
- Expression of technical requirements in an acceptable form
- Definition of MOPs and TPMs
- Validation of requirements
- Development of specification documents

Program Systems Engineer

Like the Project Systems Engineer, the Program Systems Engineer is also responsible for being *aware of* technology developments. For a program, they must show competency to *direct* the following:

- Conversion of functional and behavioral expectations into technical terms with performance requirements
- Expression of technical requirements in an acceptable form
- Definition of MOPs and TPMs
- Validation of requirements
- Development of specification documents

Individuals should also display the *ability to define* the scope of the technical problem for their program as well as the design and product constraints and technical requirement definition policies for the agency or center.

SE 1.3 Logical Decomposition

Individuals display competency in this area through achieving the transformation of the defined set of technical requirements into a set of logical decomposition models and their associated set of derived technical requirements for input to the design solution efforts. This includes the allocation of requirements, resolution of conflicts between derived requirements, and the validation of the derived technical requirements. Depending upon the role of the individual, the proficiency levels achieved in the *Logical Decomposition* sub-competency are as follows:

Technical Engineer/Project Team Member

Individuals are responsible for being able to *contribute to* the decomposition, allocation, identification, and resolution of requirements and their resulting conflicts. They should also *contribute to* the validation of derived requirements and the development of the specification document.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads must be *able to* decompose, allocate, and identify requirements as well as resolve any requirement conflicts. They also have the responsibility to be *able to* validate derived requirements and develop the specification document.

Project Systems Engineer

A Project Systems Engineer shows the ability to be able to *direct* the following for a system:

- Decomposition, allocation, and identification of requirements
- Resolution of requirement conflicts
- Validation of derived requirements
- Development of the specification document

Program Systems Engineer

Competent individuals demonstrate successful *direction* of decomposition, allocation, identification, and resolution of requirements and their conflicts for a program. Additionally, they must also *direct* the validation of derived requirements and the development of the specification document.

Individuals in this position are also responsible for *defining* logical decomposition policies for the agency or center involved.

SE 1.4 Design Solution Definition

Competency in *Design Solution Definition* is demonstrated through the translation of decomposition models and derived requirements into alternative solutions. This is

followed by the analysis of each alternative and selection of a preferred alternative that is fully defined to satisfy the previously determined technical requirements. This includes the development of a set of ‘make-to’, ‘buy-to’, ‘reuse-to’, or set of ‘assemble- and integrate-to’ specified requirements, interface specifications, requirements for enabling products, a product verification plan, and a product validation plan. Depending upon the role of the individual, the proficiency levels achieved in the ***Design Solution Definition*** sub-competency are as follows:

Technical Engineer/Project Team Member

Individuals must be ***able to*** recommend the best design solution. Additionally, they must also ***contribute to*** the definition and evaluation of alternative design solutions as well as the generation, verification, and baselining of the full design description and design solutions respectively.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads must be ***able to*** define, evaluate, and recommend alternative design solutions. They must also be ***able to*** generate a full design description as well as verify and baseline the selected design solution.

Project Systems Engineer

A Project Systems Engineer will be ***able to*** select the best design solution for a system. They will also ***direct*** the definition and evaluation of alternative design solutions for a system. Additionally, they are responsible for ***directing*** the generation of the full design description, verification of the design solution, and baselining of the selected design solution.

Program Systems Engineer

For a program, the Program Systems Engineer must demonstrate the ***ability*** to select the best design solution and ***define*** design solution policies for the agency or appropriate center(s).

Lastly, they must ***direct*** the following for a program:

- Definition of alternative design solutions
- Evaluation of alternative design solutions
- Generation of full design description
- Verification of the design solution
- Baselining of selected design solution

SE 2.0 PRODUCT REALIZATION

Product Realization includes the realization of results in the delivery of the completed system. They should meet the design specifications and stakeholder expectations. This requires products to be produced, acquired, reused or coded; integrated into a higher level assembly; verified against design specifications; validated against stakeholder

expectations; and transitioned to the next level of the system. Sub-competencies for this section include Product ***Implementation, Integration, Verification, Validation, and Transition.***

Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

SE 2.1 Product Implementation

Individuals who demonstrate competency in this area are capable of generating a specific product through buying, making, or reusing parts or the whole while satisfying the design solution definition specified requirements. This includes preparation of an implementation strategy, review of vendor technical information, inspection of delivered, built, or reused products, and preparation of product support documentation for integration. Depending upon the role of the individual, the proficiency levels achieved in the ***Product Implementation*** sub-competency are as follows:

Technical Engineer/Project Team Member

Individuals are ***aware*** that product implementation requires enabling products and lower level products.

They are also expected to ***contribute*** at a number of levels. Firstly, they ***contribute*** to the review of existing product configuration documentation. Secondly, with regard to product purchase, they also ***contribute*** to the following:

- Review of technical information for the product
- Assisting in the inspection of the product
- Assessing the validation status of the product
- Assessing the status of the enabling product

At the product fabrication level, individuals ***contribute*** by enabling the status assessment, monitoring fabrication, and preparing support documentation for the product. Additionally, such individuals ***contribute*** to the acquisition of product reuse by doing the following:

- Reviewing product technical information
- Assessing status of supporting documentation and user manuals
- Assessing enabling products status
- Assisting in requests to acquire the product from government sources
- Assisting in product inspection

Lastly, they contribute to the capture of work products from product implementation activities.

Subsystem Lead

Subsystem Leads must be ***able to*** provide systems engineering (SE) participation in acquiring the product for reuse for a subsystem or simple project by a) reviewing the product technical information; b) assessing the supporting documentation and user manuals status; c) assessing the enabling product status; d) assisting in the requests to acquire the product from government sources; and e) inspecting the product.

They must also be ***able to*** provide SE participation in the product purchase through the review of the technical information and assessment of validation status and enabling status of the product. This includes providing SE participation in the product's fabrication by assessing the enabling status and monitoring fabrication of the product.

Individuals competent in this area will also ***contribute to*** the following:

- Acquisition or development of enabling products
- Development of next lower-level products
- Readiness of existing product configuration documentation
- Development of the product implementation strategy

They must also ***contribute to*** SE participation in the product purchase by preparing vendor requests and inspecting the product. Subsystem Leads at the subsystem level are to ***contribute to*** the preparation of support documentation.

Subsystem Leads are also required to ***participate in*** the capture of work products from product implementation activities.

Project Systems Engineer

A Project Systems Engineer ***develops*** the product implementation strategy. They also ***ensure*** the acquisition or development of enabling products, the development of next lower-level products, and the readiness of existing product configuration documentation for a given system.

Engineers at this level are also responsible for ***directing*** a variety of SE aspects of the project. They are required to participate in the product purchase by reviewing the technical information of the product, preparing the vendor requests, inspecting the product, assessing the validation status of the product, and assessing the enabling status of the product for a given subsystem.

For a subsystem, they also must ***direct*** the SE participation in the product's fabrication. This includes assessing the product's status, monitoring the product's fabrication, and preparing the support documentation. Individuals are also required to ***direct*** the SE participation in acquiring reuse of the product by a) reviewing the product's technical information; b) assessing the supporting documentation and user manuals status; c) assessing of enabling products status; d) assisting in requests to acquire the product from government sources; and e) product inspection.

Lastly, engineers in this category are responsible for **directing** the capture of work products from product implementation activities.

Program Systems Engineer

The Program Systems Engineer is responsible for **ensuring** the acquisition or development of enabling products, development of next lower-level products, and the readiness of existing product configuration documentation for a program.

The engineer must also be able to **direct** the development of the product implementation strategy. This includes SE participation in the product purchase by reviewing the technical information of the product, preparing the vendor requests, inspecting the product, assessing the validation status of the product, and assessing the enabling status of the product for a given program.

In addition, they must demonstrate competency in their ability to **direct** the following:

- Assessment of enabling the status of the product
- Monitoring the fabrication of the product
- Preparing the support documentation

The Program Systems Engineer will **direct** the SE participation in acquiring the product for reuse by reviewing the product's technical information, assessing the supporting documentation and user manuals status, assisting in requests to acquire the product from government sources, and assisting in product inspection. They should also **direct** the capture of work products from product implementation activities.

Finally, this individual is responsible for **defining** product implementation policies for the agency or center(s).

SE 2.2 Product Integration

Individuals identifying with the appropriate level of responsibility for **Product Integration** are required to be competent in the assembly and integration of lower-level validated end products in order to satisfy the design solution and definition requirements. This includes the preparation of the integration plans and procedures, obtaining and confirming products to be integrated, preparation of the integration environment, and preparation of product support documentation, which are outlined as follows:

Technical Engineer/Project Team Member

Individuals must **understand** integration preparation. They are also responsible for being **aware** that lower-level products must be obtained and validated and of the processes to prepare the integration environment.

To achieve competency, they must also **contribute to** the assembly and integration of a product as well as the capture of work products and related information from product integration activities.

Subsystem Lead

A Subsystem Lead is responsible for *participating in* assembly and integration of received products and the capture of work products as well as related information from product integration activities. They must also *contribute to* the development of product integration strategy, detailed planning for integration, and integration sequence and procedures for a subsystem or simple project.

Individuals achieving in this area of competency are also required to *ensure* that the existing product configuration documentation will permit product integration. They must also *ensure* lower-level products are in place and have been validated as well as the readiness of enabling integration products and the integration workforce.

Project Systems Engineer

Individuals in this competency area demonstrate proficiency in *developing* the product integration strategy. For a system, they must *direct* the following:

- Development of detailed planning for integration
- Development of integration sequence and procedures
- Assembly and integration of received products
- Capture of work products and related information from product integration activities

For a system, they must also *ensure* the existing product configuration documentation will permit product integration and lower-level products are in place and have been validated for a system. Finally, they will *ensure* the readiness of a product's integration enabling products and integration workforce.

Program Systems Engineer

The Program Systems Engineer is responsible *directing* the development of a product integration strategy, followed by a detailed plan for integration, and the integration sequences and procedures. They are also responsible for the *direction of* the assembly and integration of received products as well as the capture of work products and related information from product integration activities.

Individuals should also display the ability to *ensure* that the existing product configuration documentation will permit product integration and lower-level products are in place and have been validated for a program. Additionally, this includes *ensuring* the readiness of a product's integration enabling products and integration workforce.

Lastly, those proficient in this competency can *define* the product integration policies for the agency or center(s) involved.

SE 2.3 Product Verification

Personnel who have achieved competency in this area have demonstrated that the end of a product generated from implementation or integration conforms to its design solution definition requirements. This includes preparation for verification efforts, analyzing the

outcomes of verification which includes identifying anomalies and establishing recommended corrective actions, and preparing a product verification report providing the evidence of product conformance with the applicable design solution definition requirements. Depending upon the role of the individual, the proficiency levels achieved in the **Product Verification** sub-competency are as follows:

Technical Engineer/Project Team Member

Individuals displaying competency in this area are to be **aware of** the steps to prepare for product verification. They must be **able to** identify verification anomalies or conformance.

They are responsible for being able to **contribute to** product verification, analysis of product verification outcomes, preparation of product verification report, and capture of work products and related information from product verification activities.

Subsystem Lead

For a subsystem or simple project, a Subsystem Lead will **review** a product verification plan. This includes **participation in** 1) the preparation of the product verification report; 2) the capture of work products and related information from product verification activities; 3) a product's verification; 4) analysis of verification outcomes; and 5) identification of anomalies and corrective action recommendations is also included.

For a subsystem or simple project, the Subsystem Lead will **establish** product conformance, and **contribute to** obtaining 1) product verification enabling products; 2) the specification and configuration baseline against which the verification is to be made; and 3) the readiness of the verification environment.

Project Systems Engineer

A Project Systems Engineer **reviews** the product verification plan for a system. Individuals demonstrate competency by **ensuring** product verification enabling products are obtained, specification and configuration baseline against which the verification is to be made are obtained, and the readiness of the verification environment.

Responsibilities include **directing** the following for a system:

- Product verification
- Analysis of product verification outcomes
- Identification of anomalies and corrective action recommendations
- Preparation of product verification report
- Capture of work products and related information from product verification activities

Finally, those competent in this area are **able to** establish a product's conformance or select the appropriate corrective action as well as capture the work product's and related information from product verification activities.

Program Systems Engineer

A competent Program Systems Engineer in this area is responsible for the **review** of a product's verification plan and the **definition** of that product's verification policies for the agency or appropriate center(s) for a given program.

For a program, individuals in this area demonstrate competency by **ensuring** product verification enabling products are obtained, specification and configuration baseline against which the verification is to be made are obtained, and the readiness of the verification environment.

Responsibilities include **directing** a) product verification; b) analysis of product verification outcomes; c) identification of anomalies and corrective action recommendations; d) preparation of product verification report; e) capture of work products and related information from product verification activities.

The **ability to** establish product conformance or select corrective action is the final requirement for this point of competency for individuals in this specification.

SE 2.4 Product Validation

Product Validation includes the ability to confirm that a verified end product satisfies its intended use when placed in its intended environment. Assurance that any anomalies discovered during validation are resolved appropriately prior to product transition is also required. This includes preparations to conduct validation (including identifying anomalies and establishing recommended corrective actions). **Product Validation** also includes preparation of the product validation report to provide evidence of its conformance with the expectations baseline provided by the stakeholders. Roles and responsibilities vary among the different levels of **Product Validation** and are defined as follows:

Technical Engineer/Project Team Member

Individuals must be **able to** identify validation anomalies. They must also **contribute to** the following:

- Execution of product validation
- Analysis of product validation outcomes
- Preparation of product validation report
- Capture of work products and related information from product validation activities

They must also be **aware of** steps to prepare for product validation.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads are required to **review** the product validation plan for a subsystem or simple project. They must also **establish** the product conformance and **participate in** the following:

- Product validation
- Analysis of product validation outcomes
- Identification of anomalies and corrective action recommendations
- Preparation of product validation report
- Capture of work products and related information from product validation activities

Finally, Subsystem Leads **contribute to** obtaining product validation enabling products, getting the end product to be validated in place, obtaining stakeholder expectations baseline against which the validation is to be made, and the readiness of the validation environment.

Project Systems Engineer

A Project Systems Engineer is **able to establish** product conformance or selective corrective action, and **review** the product validation plan. For a system, they also **direct** a) product verification; b) analysis of product verification outcomes; c) identification of anomalies and corrective action recommendations; d) preparation of product verification report; e) capture of work products and related information from product verification activities.

Demonstration that the individual can **ensure** product validation enabling products are obtained, getting the end product to be validated in place, stakeholder expectations baseline against which the validation is to be made is obtained, and the readiness of the validation environment are also required.

Program Systems Engineer

The Program Systems Engineer must demonstrate the **ability** to establish product conformance or select corrective action for a system and **define** design solution policies for the agency or appropriate center(s).

They must **direct** the following for a program:

- Product validation
- Analysis of product validation outcomes
- Identification of anomalies and corrective action recommendations
- Preparation of product validation report
- Capture of work products and related information from product validation activities

Competency is also defined by the Program Systems Engineer's ability to **ensure** that 1) product validation enabling products are obtained; the end product to be validated is in place; and, stakeholder baseline expectations are obtained. The Program Systems Engineer also ensures the readiness of the validation environment.

SE 2.5 Product Transition

Competency in **Product Transition** is defined by the transition of the verified and validated product to the next higher-level customer. This includes preparing to conduct product transition, evaluating the product, personnel, and enabling product readiness for product transition, preparing sites, and generating required documentation to accompany the product.

Technical Engineer/Project Team Member

A Technical Engineer/Project Team Member must be *aware of* steps to prepare for product transition and that product transition can be the next higher level for integration or to end user. They are also required to *contribute to* the capture of work products and related transformation from product transition activities.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads *oversee* packaging, storing, and moving the end product to the shipping location. They *ensure* the end product and its documentation transition to the customer are completed and that the receiving sites are ready for the end product.

Individuals fulfilling competency requirements in this area *participate in* a) documentation that will accompany the product; b) product transition procedures personnel availability skills; c) packaging material, handling equipment, storage facilities, and shipping services; and d) capture of work products and related information from product transition activities.

Project Systems Engineer

A Project Systems Engineer will *develop* a product transition strategy and *oversee* packaging, storing, and moving the end product to the shipping location for a system. Additionally they *direct* the capture of work products and related information from product transition activities.

Finally, such individuals are responsible for *ensuring* the following for a system:

- Documentation that will accompany the product
- Product transition procedures
- Personnel availability skills
- Packaging material, handling equipment, storage facilities, and shipping services
- Capture of work products and related information from product transition activities

Program Systems Engineer

The Program Systems Engineer demonstrates the capacity to *oversee* packaging, storing, and moving the end product to its shipping location, *directing* the development of product transition strategy and capture of work products and related information from product transition activities, and *defining* product transition policies for the agency or appropriate center(s) for a program.

These individuals are responsible for *ensuring* the a) documentation that will accompany the product; b) product transition procedures; c) personnel availability skills; d) packaging material, handling equipment, storage facilities, and shipping services; and e) capture of work products and related information from product transition activities for a program.

SE 3.0 TECHNICAL MANAGEMENT

Technical Management encompasses the management of technical activities during the life-cycle of the project. This includes technical planning, requirements management, interface management, technical risk management, configuration management, technical data management technical assessment, and decision analysis.

There are eight aspects (sub-competencies) of **Technical Management**:

- SE 3.1 Technical Planning
- SE 3.2 Requirements Management
- SE 3.3 Interface Management
- SE 3.4 Technical Risk Management
- SE 3.5 Configuration Management
- SE 3.6 Technical Data Management
- SE 3.7 Technical Assessment
- SE 3.8 Technical Decision Analysis

Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

SE 3.1 Technical Planning

Individuals proficient in the sub-competency of **Technical Planning** are responsible for the planning of the application and management of each common technical process. This includes the identification, definition, and planning of the technical effort necessary to meet project objectives. To accomplish these tasks, individuals must be competent in preparing or updating a planning strategy for each of the technical processes. They must determine the deliverable work products from technical efforts, technical reporting requirements, entry and success criteria for technical reviews, and product and process measures to be used.

They must also determine critical technical events, data management approach, technical risks to be addressed during the planning effort, and tools and engineering methods to be employed. Finally, such proficient individuals must be able to determine the approach to acquire and maintain technical expertise needed, preparing the systems engineering management plan (SEMP) and other technical plans, obtaining other technical plans and stakeholder commitments to the technical plans, and issuing authorized directives to implement the technical work. Depending upon the role of the individual, the proficiency levels achieved in the **Technical Planning** sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members are responsible for being *aware* that common technical processes need to be planned and that stakeholders cannot be ignored during the technical planning process. They must be *able to* follow technical work directives. *Contribution to* technical planning by providing inputs as requested and capture of work products and related information from technical planning activities is also required of the position.

Subsystem Lead

Subsystem Leads must be *able to* obtain stakeholder agreements with the technical plans for a subsystem or simple project. They must *participate in* the following for a subsystem or simple project:

- Collection of information for technical planning
- Definition of the technical work to be done
- Schedule, organize, and cost the technical work
- Development of formal technical plans (i.e., SEMP, product verification plan, product validation plan, etc.)
- Development of technical work directives
- Capture of work products and related information from technical planning activities

Project Systems Engineer

A Project Systems Engineer *develops* or updates planning strategies for common technical processes and technical work directives for a system. They are responsible for *direction* of the development of formal technical plans (i.e., SEMP, product verification plan, product validation plan, etc.) and the capture of work products and related information from technical planning activities.

Such engineers will also be *able to* collect information for technical planning, define technical work to be done, schedule, organize, and cost the technical work, and obtain stakeholder agreements with the technical plans.

Program Systems Engineer

The Program Systems Engineer is responsible for *developing* or updating planning strategies for common technical processes as they pertain to a program. They must be *able to* obtain stakeholder agreements with the technical plans and define the technical planning policies for the agency or appropriate center(s) for a program.

The engineer must also be able to *direct* the following for a program to demonstrate competency in the following:

- Collection of information for technical planning
- Definition of technical work to be done
- Schedule, organize, and cost the technical work
- Development of technical work directives
- Capture of work and related information from technical planning activities

SE 3.2 Requirements Management

Management of the technical requirements is one component individuals are responsible for in the competency area of **Requirements Management**. This includes providing bi-directional traceability and managing changes to establish requirement baselines over the life-cycle of the system products. Preparing or updating a strategy for requirements management, selecting an appropriate requirements management tool, training technical team members using established requirement management procedures, and conducting expectation and requirements traceability is another component. The final component for proficiency in this area is the management of expectations, requirement changes, and communicating expectation and requirement change information.

Technical Engineer/Project Team Member

Proficient individuals in this competency level are to be *aware of* activities to prepare for requirements management. They must be *able to* review requirement statements to ensure compliance with guidelines. *Contribution to* the collection of requirements for documenting and the development and maintenance of compliance matrices is also required.

Subsystem Lead

To achieve proficiency as a Subsystem Lead in this sub-competency, individuals must be *able to* track between baselines and identify and propose changes to out-of-tolerance technical parameters for a subsystem or simple project.

They must *participate in* documenting requirements in the proper format, validating the baseline for these requirements, the development and maintenance of compliance matrices, and the capture of work products from requirement management activities.

Subsystem Leads are required to *contribute to* strategies for requirement management, review ECPs and provide recommendations, and disseminate approved changes.

Project Systems Engineer

Individuals in this competency area demonstrate proficiency in *developing* strategies for requirements management for a system. For a system, they must *direct* the following:

- Reviews of ECPs and provide recommendations
- Implementation of change procedures
- Dissemination of approved changes
- Capture of work products from requirement management activities

Ensuring the requirements for a system are documented in proper format and that a baseline is validated is also required of such individuals. This also includes the identification of out-of-tolerance technical parameters.

Competent Project Systems Engineers are required to be **able to** track between baselines and develop and maintain compliance matrices. Lastly, they are in charge of **approval** of changes to out-of tolerance technical parameters for a system.

Program Systems Engineer

The Program Systems Engineer achieves proficiency upon the ability to **develop** strategies for requirements management for a program. They must also **approve** changes to out-of-program technical parameters and **ensure** that requirements are documented in proper format, their baseline is validated, and that out-of-tolerance technical parameters are identified.

Additionally, individuals are responsible for the **direction of** the following as it pertains to a program:

- Tracking between baselines
- Development and maintenance of compliance matrices
- Review ECPs and provide recommendations
- Implementation of change procedures
- Dissemination of approved changes
- Capture of work products from requirement management activities

SE 3.3 Interface Management

Those who have reached full proficiency in the sub-competency of **Interface Management** are able to establish and use a formal interface management to maintain the interface definition, details, and compliance among the end products and enabling products. This includes preparing interface management procedures, identification of interfaces, maintaining interface documentation, disseminating interface information, and conducting interface control. Depending upon the role of the individual, the proficiency levels achieved in the **Interface Management** sub-competency are as follows:

Technical Engineer/Project Team Member

Personnel in this competency level must be **aware of** the activities necessary to prepare for managing the interface. They must also **contribute to** the following:

- Interface management during system design
- Management of the interface during product integration
- Interface control activities
- Capture of work products from interface management activities

Subsystem Lead

A proficient Subsystem Lead **contributes to** the development of procedures for interface management for a subsystem or simple project. They also **participate in** the following for a subsystem or simple project: a) interface management during system design; b) management of the interface during product integration; c) interface control activities; and d) capture of work products from interface management activities.

Project Systems Engineer

For a system, individuals in this proficiency level **develop** procedures for interface management. Project Systems Engineers are responsible for **directing** the following for a system:

- Management of the interface during system design
- Management of the interface during product integration
- Interface control activities
- Capture of work products from interface management activities

Program Systems Engineer

A competent Program Systems Engineer in this area is responsible for the **direction** of the following:

- Interface management during system design
- Management of the interface during product integration
- Interface control activities
- Capture of work products from interface management activities

Finally, such individuals are responsible for the **definition** of management policies as they pertain to the interface for the agency or appropriate center(s).

SE 3.4 Technical Risk Management

Proficiency in the sub-competency of **Technical Risk Management** is achieved through regular examination of the risks of technical deviations from the plans. This involves identifying potential technical problems before they occur so that risk-handling activities can be planned and invoked as needed across the life of the product or project to mitigate impacts on meeting technical objectives. Additionally, developing the strategy for technical risk management, identification of technical risks, conducting technical risk assessment, and preparing for technical risk mitigation are included. Monitoring the status of each technical risk and implementing technical risk mitigation and contingency action plans when applicable thresholds have been triggered are also included in this competency area.

Technical Engineer/Project Team Member

Individuals at this proficiency level are responsible for being **aware of** activities to prepare for technical risk management. They also **contribute to** the following:

- Identification of risk

- Risk analysis
- Risk monitoring
- Development of risk mitigation contingency action plans
- Implementation of plans

Subsystem Lead

Subsystem Leads must be *able to* perform risk analysis and recommend risks for mitigation. Such individuals are also asked to *contribute to* strategy development to conduct technical risk management and *participate in* the following:

- Identification of risk
- Stakeholder coordination
- Development of risk mitigation/contingency action plans
- Plan implementation
- Capture of work products from technical risk management activities

This participation is required for all individuals at this competency level for a subsystem or simple project.

Project Systems Engineer

A Project Systems Engineer will *develop* strategies to conduct technical risk management. Such engineers are responsible for the *direction* of the following for a system:

- Risk analysis
- Development of risk mitigation/contingency action plans
- Plan implementation
- Capture of work products from technical risk management activities

Finally, they will be *able to* conduct risk identification, stakeholder coordination, and select risks for mitigation as they relate to a system.

Program Systems Engineer

The Program Systems Engineer must demonstrate the *ability to* select risks for mitigation and *define* the technical risk management policies for the agency or appropriate center(s).

They must *direct* the following for a program:

- Identification of risk
- Stakeholder coordination
- Risk analysis
- Development of risk mitigation/contingency action plans
- Plan implementation
- Capture of work products from technical risk management activities

SE 3.5 Configuration Management

Demonstrating competency in **Configuration Management** includes identifying the configuration of the product at various points in time, systematically controlling changes to the configuration of the product, maintaining the integrity and traceability of the configuration of the product, and preserving the records of the product configuration throughout its life-cycle. Disposal of these records in accordance with NASA Procedural Requirement (NPR) 1441.1, “NASA Records Retention Schedules,” is also necessary and accomplished by establishing configuration management strategies and policies, identifying baselines to be under configuration control, maintaining the status of configuration documentation, and conduct of configuration audits. Roles and responsibilities vary with the level of proficiency required of the individual and are as follows:

Technical Engineer/Project Team Member

Personnel at this level must be *aware of* several aspects of a product including the activities to prepare for a configuration management and to a baseline configuration, configuration change control, and the content of configuration control. Additionally, they are responsible for *contributing to* configuration audits and capture of work products from configuration management activities.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads *participate in* the development of strategies to conduct configuration management, configuration audits, and capture of work products from configuration management activities.

Individuals fulfilling competency requirements in this area *contribute to* the following:

- Systems engineering (SE) participation in configuration control baseline by identifying items to control and establish a baseline
- configuration change control
- identification of content for configuration control

These contributions are all related to a subsystem or simple project with which the individual is involved.

Project Systems Engineer

A Project Systems Engineer must *develop* the strategies to conduct the configuration management. They must also be *able to* identify items to be placed under configuration control, establish a baseline, and identify content configuration control.

Finally, such individuals are responsible for *directing* the SE participation in configuration audits and the capture of work products from configuration management activities for a system.

Program Systems Engineer

Program Systems Engineers for a program are to *define* the configuration management policies for the agency or appropriate center(s) and are *able to* identify content of configuration control. Additionally they *contribute to* configuration change control for a program. Lastly, they are responsible for the *direction of* the following:

- SE participation in the configuration of the control baseline by identifying items to control and establish a baseline
- Capture of work products from configuration management activities
- Development of strategies to conduct configuration management

SE 3.6 Technical Data Management

Individuals demonstrating proficiency in the *Technical Data Management* area are responsible for managing the technical data. This includes identifying and controlling data requirements, acquiring, accessing, and distributing data needed to develop, manage, operate, and support system products. They must manage and dispose data as records, analyze data use, obtain technical data feedback for managing the contracted technical efforts, and assess the collection of appropriate technical data and information. Establishing technical data management strategies and policies, maintaining stored technical data, providing technical data to authorized parties, and collection and storage of required technical data are also included in achieving proficiency in this area. Individuals involved in this competency area are subject to differing roles as they apply to their level of involvement in the project. These roles are detailed as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members are to *provide* data for storage and lessons learned on a project. They are also required to be *aware of* activities to prepare for technical data management as well as measures to protect and procedures to access technical data.

Subsystem Lead

A proficient Subsystem Lead *contributes* to strategies to conduct technical data management and the development of procedures to access technical data. They are also *aware of* measures to protect technical data and *provide* data for storage and lessons learned for a subsystem or simple project.

Project Systems Engineer

For a system, individuals in this proficiency level *ensure* the measures to protect technical data. Such engineers are required to *develop* strategies to conduct technical data management as well as *direct* data for storage, development of lessons learned, and the development of procedures to access technical data for a system.

Program Systems Engineer

A competent Program Systems Engineer in this area is required to *ensure* measures to protect technical data. They also *direct* the following for a program:

- Development of strategies to conduct technical data management
- Data for storage
- Development of lessons learned
- Development of procedures to access technical data

Finally, such individuals are responsible for the **definition** of technical management policies for the agency or appropriate center(s).

SE 3.7 Technical Assessment

Competency in **Technical Assessment** is defined as the ability to monitor progress of the technical effort and provide statistical information for support of the system design, product realization, and technical management efforts. This includes developing technical assessment strategies and policies, assessing technical work productivity, assessing product quality, and conducting technical reviews. Proficiency in this area requires different levels of competency for differing members on the project.

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members are to be **aware of** activities to prepare for technical assessments, assessments of technical work productivity, the review types and their purposes, as well as the quality assessment measures against which technical requirements are compared. They are also to **contribute to** the review of material preparation, identification and resolution of action items, and the capture of work products from technical assessment activities.

Subsystem Lead

Subsystem Leads must be **able to** identify process measures, monitor progress against plans, and identify type and when a technical review is needed for a simple project or subsystem.

They must **participate in** the determination of the degree to which a product satisfies requirements, product performance variances and recommend corrective action, and capture of work products from technical assessment activities for a subsystem or simple project.

Lastly, individuals at this level must **contribute to** strategies to conduct the technical assessments for a subsystem or simple project.

Project Systems Engineer

The Project Systems Engineer must demonstrate the **ability to** select corrective action and identify when a technical review is needed and what type to have. Additionally, they should be **able to** chair a variety of technical review boards such as a Preliminary Design Review (PDR), Critical Design Review (CDR), or Technical Readiness Review (TRR). They also **develop** strategies to conduct technical assessments and **monitor** a product's progress against established plans.

They must **direct** the following for a program:

- Identification of process measures
- Determination of the degree to which the product satisfies requirements
- Determination of the product's performance variances
- Review material preparation
- Action item identification and solution
- Capture of work products from technical assessment activities

Program Systems Engineer

A Project Systems Engineer *monitors* the progress of a product against the program's plans. They are *able to* select corrective action when problems arise and identify when a technical review is needed and what type it should be.

Direction of the following is also necessary:

- Development of strategies to conduct technical assessments
- Identification of process measures
- Determination of the degree to which a product satisfies the requirements
- Determination of the product's performance variances
- Review material preparation
- Action items identification and resolution
- Review material preparation
- Action item identification and resolution
- Capture of work products from technical assessment activities

They are also required to be able to *define* the technical assessment policies for the agency or appropriate center(s).

SE 3.8 Technical Decision Analysis

Competency in *Technical Decision Analysis* is defined by an individual's responsibility for the evaluation of technical decision issues, technical alternatives, and their uncertainties to support decision making. This is done throughout technical management, system design, and product realization to evaluate the impact of decisions on performance, cost, schedule, and technical risk. This includes establishing guidelines for determining which technical issues are subject to formal analysis processes, defining the criteria for identifying and evaluating alternative solutions to address decision issues, selecting evaluation methods, selecting recommended solutions, and reporting the results and findings with recommendations, impacts, and corrective actions.

Technical Engineer/Project Team Member

Personnel at this proficiency level are to *apply* decision making guidelines and *contribute to* the identification and evaluation of alternatives and the capture of work products from decision analysis activities. Additionally, they must be *able to* recommend evaluation methods and solutions.

Subsystem Lead

For a subsystem or simple project, Subsystem Leads *participate in* establishing the criteria definitions for the types, ranges, and ranks of criteria as well as the capture of work products from decision analysis activities on a simple project or subsystem. They also *contribute to* developing the guidelines for when to apply formal decision making procedures and determining who will make such decisions.

Project Systems Engineer

For a system, a Project Systems Engineer *develops* the guidelines for when to apply formal decision making procedures and determining who will make such decisions. They also must *establish* the definitions for the types, ranges, and ranks of criteria and be *able to* select an evaluation method and solution for a system. Additionally, they are responsible for the *direction* of the identification and evaluation of alternatives and the capture of work products from decision analysis activities.

Program Systems Engineer

Program Systems Engineers for a program are to *define* the configuration management policies for the agency or appropriate center(s) and are *able to* select evaluation methods and solutions. Lastly, they are responsible for the *direction of* the following for a program:

- Development of guidelines for when to use formal decision making and who will make those decisions
- Establishment of the definitions for type, range, and rank of criteria
- Identification and evaluation of alternatives
- Capture of work products from decision analysis activities

DETAILED COMMON MANAGEMENT COMPETENCIES

C 1.0 NASA INTERNAL & EXTERNAL ENVIRONMENTS

NASA Internal and External Environments ensures that the expression of an individual's abilities aligns with the various ways in which NASA functions. There are three main components to **NASA Internal and External Environments**: *agency structure, mission, and internal goals, NASA project management/systems engineering procedures and guidelines, and external relationships*. Individuals demonstrating competency in this area should be accomplished in all three of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

C 1.1 Agency Structure, Mission, and Internal Goals

Measures the individual's ability to successfully adapt their work approach and style to match NASA's functional, social, cultural, and political structure in order to achieve agency, mission directorate, field center, program and project goals. Depending upon the

role of the individual, the proficiency levels achieved in the *Agency Structure, Mission, and Internal Goals* sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members must have *knowledge of* a) agency structure, goals at all levels, vision, mission, plans and objectives; b) how to align technical activities and metrics with agency vision, mission, plans, and objectives for both the agency and the center(s) involved.

Subsystem Lead/Small Project Manager

Subsystem Lead/ Small Project Managers must be *able to* perform system engineering activities within the agency structure and across programs, centers, and NASA, as needed to achieve project and subsystem goals.

They are required to a) *contribute* to activities addressing alignment of a subsystem's technical activities with the agency's vision, mission, plans, and objectives; b) *perform* system engineering activities within the center structure and across divisions and center as needed to achieve project subsystem goals; and c) *contribute* to alignment of the subsystem's activities and metrics with center vision, mission, plans, and objectives.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be *able to* perform project management and systems engineering activities within the center structure and across divisions and the center, as needed to achieve project and system goals.

They are expected to *lead and manage* project management and systems engineering activities to achieve project and system goals within the agency structure and across programs, centers, and NASA. They are also responsible for the alignment of the system's project/technical activities and metrics with the agency's vision, mission, plans, and objectives.

Finally, they are to *contribute to* the establishment of the agency's technical requirements and infrastructure.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers are expected to *establish* program/project and systems engineering requirements needed to achieve goals within the agency structure and ensure mission success. *Establishing* the center's program/technical requirements and infrastructure that is to be aligned with agency structure is also required.

Responsibilities of such individuals also include a) *making decisions* from an agency perspective with an understanding of NASA's functional, social, cultural, and political environments to ensure mission success; b) *lead* the alignment of technical activities and metrics with the vision, mission, plans, and objectives within the agency; and c) *lead* the alignment of a center's activities and metrics with the vision, mission, plans, and objectives of the agency.

C 1.2 NASA Project Management/Systems Engineering Procedures and Guidelines

This sub-competency focuses on the capacity to structure activities to comply with relevant agency and center processes and guidelines including NASA Procedural Requirements (NPR) 7120.5 and NPR 7123.1. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members must be *knowledgeable of* NASA engineering systems and project management policies and guidelines outlined in NASA procedures and guidelines documents. Additionally, such individuals must have *knowledge of* center engineering of systems and PM policies and guidelines outlined in center procedures and guidelines documents.

Subsystem Lead/Project Manager

Subsystem Lead/Project Managers must be able to *structure and manage* activities to comply with NASA and center engineering systems for a subsystem or simple project.

Project Managers/Project Systems Engineer

Project Managers/Project Systems Engineers are responsible for *structuring and managing* activities to comply with systems engineering and PM policies and guidelines as they pertain to NASA and the center. Additionally, individuals at this competency level will *contribute to* the review and development of project management and systems engineering policies and guidelines to ensure mission success as they pertain to the agency or appropriate center(s).

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineer should *establish* requirements for activities that comply with the systems engineering and PM policies guidelines for both the agency and center(s) involved. They must also *lead* the review and development of program/project management and systems engineering policies and guidelines to ensure mission success and support agency policy as they pertain to the agency and center(s) involved. Lastly, such individuals are to *assess* the technical processes and guidelines for both entities.

C 1.3 External Relationships

External Relationships focuses on maintaining cognizance of the policies and procedures of other organizations. This is accomplished by participating in professional societies or organizations, contributing to professional development activities, and researching best practices from external sources (e.g., industry standards, procedures, regulations, universities), and by developing applicable international partnerships and agreements and complying with International Traffic in Arms Regulations (ITAR), international agreements, and standards. Depending upon the role of the individual, the proficiency levels achieved in the *External Relationships* sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members are expected to *participate in* professional societies and/or organizations as well as technical activities that conform to industry and professional standards, procedures, and regulations. They must also be *aware of* international partnerships, agreements, standards, and ITAR as they relate to the team's technical activities.

Subsystem Lead/ Small Project Manager

Such individuals are expected to *contribute to* professional societies and/or organizations as well as the development of international partnerships and agreements as they relate to the subsystem. They are also asked to *maintain* knowledge of current up-to-date research and key individuals in the field.

They are required to *manage* technical activities that conform to industry and professional standards, procedures, and regulations and *comply* with ITAR and international agreements and standards as they relate to the subsystem.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineer must be *compliant* with ITAR and international agreements and standards as they relate to the project. They will *participate in* leadership roles within professional societies and organizations and *maintain* knowledge of current up-to-date research and key individuals in the fields of interest.

They are also asked to *develop* key contacts within the discipline inside and outside of NASA and *lead and manage* the following:

- technical activities that conform to industry/professional standards, procedures, and regulations
- the development of international partnerships and agreements as they relate to the system

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be able to *provide* leadership to professional societies and organizations to guide the establishment of industry and professional standards, procedures, and regulations. Other requirements include a) *contributing to* the knowledge and up-to-date research in the discipline; b) *compliance* with ITAR and international agreements and standards as they relate to the program; c) *establishing* technical requirements that conform to industry and professional standards, procedures and regulations as well as international partnerships and agreements to ensure mission success as they pertain to the program.

C 2.0 HUMAN CAPITAL MANAGEMENT

Human Capital Management assures that all elements as they relate to team personnel management including identifying, recruiting, selecting, managing, and evaluating the team members to achieve a coherent, efficient, and effective project team. There are two main components to this competency: *staffing and performance* and *team dynamics and*

management. Individuals should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

C 2.1 Staffing Performance

Staffing Performance emphasizes all elements of personnel management. This includes identifying, recruiting, selecting, managing, and evaluating the team members to achieve a coherent, efficient, and effective team. This requires vigorous open communications, decision-making processes, and working relationships. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Technical Engineer/Project Team Member

Project Team Members should **be aware of**: NASA's processes for selecting, staffing, and evaluating teams.

They are also expected to **understand and achieve** the desired performance level for the assigned activities. They should also **understand** the roles and responsibilities of each team member as well as **monitor** their own performance level.

Subsystem Lead/Small Project Manager

Subsystem Lead/Small Project Managers must be able to **define** team members' roles and responsibilities for performing activities. They are also asked to **assist** in identifying and obtaining the required personnel resources for developing a subsystem; **ensure** that the team members have the appropriate skills, expertise, and experience; **monitor** the performance of a subsystem's team members; and **apply** appropriate team management techniques and concepts to guide a qualified team toward maintaining the desired performance level for a subsystem or simple project.

Project Manager/ Project Systems Engineer

Project Managers/Project Systems Engineer must **integrate** the team responsibilities and roles for each member and **monitor** the performance of their subsystems leads. They are expected to **employ** skills analysis and team selection techniques to build teams with complementary talents and the necessary skills, expertise, and experiences. Finally they are asked to **contribute to** the assessment of the agency's workforce capabilities and gaps for achieving mission success and **establish** the desired performance level and criteria of the system's workforce.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers are expected to **identify** and **obtain** the required leadership personnel resources for a program, **lead** the assessment of the Agency's capabilities and gaps for achieving mission success as they pertain to the workforce, and **monitor** performance criteria for a program's workforce to ensure mission success.

They are also asked to **establish** the following:

- Performance criteria for a program's workforce to ensure mission success
- The desired performance level for the agency's workforce

- The agency's workforce personnel and infrastructure requirements to ensure mission success
- Staffing strategies and selection criteria for recruiting, evaluating, selecting, and staffing teams for a program

C 2.2 Team Dynamics and Management

Team Dynamics and Management focuses on the importance of managing all team aspects of the workforce. This includes: working cooperatively with diverse team members; designing, facilitating, and managing team processes; developing and implementing strategies to promote team morale and productivity; and motivating and rewarding the performance of team members. Additionally, managing relationships among team members, customers, stakeholders and partners and facilitating brainstorming sessions, conflict resolution, negotiation and problem solving, communication, collaboration, integration and team meetings are also included in the sub-competency of **Team Dynamics and Management**. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Project Team Member

Project Team Members must **understand** a) the roles and responsibilities of team members, how they interact as a unit, and what motivates them to achieve peak performance; b) their own roles, responsibilities, and desired performance level for performing project/technical activities; c) how to work within the team's communication, collaboration and integration dynamics; and d) the relationships between team members, customers, stakeholders, and partners.

They are asked to **participate in** team brainstorming, conflict resolution, negotiation, and problem solving activities, **contribute to** the outcomes of team meetings to enhance success, and **manage** their own relationships among team members.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must be **able to** perform the following functions: a) **employ** appropriate team management techniques and concepts to effectively develop and motivate a team; b) **understand** each team member's capabilities, function, and the interrelationships among them; c) **lead** brainstorming, conflict resolution, negotiation, and problem solving activities for the technical team; and d) **manage** the relationships and interfaces among team members and the customers, stakeholders, and partners as they pertain to a subsystem or simple project.

Finally, such individuals are expected to **plan, lead, and facilitate** effective team meetings and the communication, collaboration, and integration dynamics for the team as they apply to a subsystem or simple project.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be **able to** execute the following: a) **communicate** the team's direction and focus to ensure mission success; b) **implement** the

incentive program for motivating and rewarding the team members' performance for a system; c) **apply** appropriate management techniques and concepts to build on team member capabilities and functions in order to facilitate the interrelationships and improve team performance; d) **establish and manage** the interfaces and relationships with team members, customers, stakeholders, and partners; and e) **create** an environment within the team that fosters opportunities to conduct activities for brainstorming, conflict resolution, negotiation, and problem solving.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineer must be able to **establish** the following:

- The incentive program to enhance performance and productivity of a program's workforce teams
- Productive relationships among a program's leadership team in order to ensure mission success; this includes managing such relationships
- The direction and focus of a program's leadership team to ensure mission success; this also includes communicating this information

They are also required to a) **identify and manage** the interfaces and relationships among the stakeholders and partners that may impact program and mission success; b) **determine and mitigate** long-term consequences of any impacts resulting from interfaces and relationships among the stakeholders and partners; c) **employ** a range of conflict resolution techniques to bring about positive change and commitment, build trust and respect, and mitigate the negative effects of conflict; d) **establish** a program's team meeting's requirements to ensure mission success; and finally, e) **plan, lead, and facilitate** effective leadership team meetings for the program.

C 3.0 SECURITY, SAFETY, AND MISSION ASSURANCE

Security, Safety, and Mission Assurance highlights the critical importance of managing a project's impact on external as well as internal elements to best ensure success. There are three main components: **security**, **workplace safety**, and **safety and mission assurance**. Individuals demonstrating competency should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

C 3.1 Security

Security focuses on the need to analyze and evaluate projects' ecological implications to ensure compliance with environmental regulations and the safety of product, users, the workforce, and the public. The development of an environmental impact statement and hazards analysis is emphasized. Depending upon the role of the individual, the proficiency levels achieved in this area are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members should **participate in** the identification of IT security requirements and other security requirements related to the subsystem. They are

also asked to be *aware of* the IT and subsystem security plans for the subsystem and its impact on the team's technical activities.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers are responsible for *managing* the following: a) identification of IT security requirements for the subsystem; b) development and implementation of the IT security plan for the subsystem; c) identification of other security requirements related to the subsystem; and development and implementation of a security plan for the subsystem.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers should *lead and manage* the identification of IT security requirements and development of the IT security plan for the system. They are also expected to perform the same actions with respect to the identification of other security requirements as they pertain to the identification of other security requirements and the development and implementation of a security plan for the system.

Such individuals are also asked to *contribute to* the establishment of program and/or agency requirements for IT security for the systems engineering and to the establishment of program and/or agency requirements for the IT security for the systems engineering.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must *lead* the development of IT security for the systems engineering and the development of other security related systems engineering. They are also responsible for *establishing* program requirements for IT security for the systems engineering and the program requirements for other security as it relates to systems engineering.

C 3.2 Workplace Safety

Workplace Safety ensures that workplace safety is an integral part of product development. This is achieved by applying systems safety analysis techniques throughout the life-cycle of a project and integrating critical hazard elimination/mitigation measures into risk management and safety plans. Depending upon the role of the individual, the proficiency levels achieved in the *Workplace Safety* sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members must be *able to* describe, identify or define the following:

- Factors that affect safety of the public, astronauts, workforce, and capital; and safety in the workplace while developing products
- Flight safety review process and preparation, review, or approval or project safety and quality management plans
- The application of systems safety analysis techniques throughout the project life-cycle
- Certificate of Flight Readiness (CoFR) process

- Processes to assign hazard levels and implement mitigation plans

Project Team Members are required to a) **perform** hazard analyses on assigned system/subsystem to identify and mitigate hazards; b) **report** analysis findings and recommendations for inclusion in risk management plan; c) **be involved** in a mishap investigation or failure review board; d) **utilize** standard safety reporting methodology; and e) **select** existing NASA safety plans for project situations with ample precedent.

Subsystem Lead/Small Project Manager

Subsystem Lead/Small Project Managers must demonstrate **experience** in the following situations:

- A mishap investigation or failure review board
- With flight safety review process and preparation, review, or approval of project safety and quality management plans

They should be **able to** describe, identify or define the following:

- The application of systems safety analysis techniques throughout the project life-cycle
- Processes to assign hazard levels and implement mitigation plans

Subsystem Lead/Managers are also expected to a) **employ** the factors that affect safety to the public, astronauts, workforce, and capital, and safety in the workplace while developing products; b) **perform** hazard analyses on assigned systems/subsystems to identify and mitigate hazards; c) **report** analysis findings and recommendations for inclusion in risk management plan; d) **participate** in CoFR process; and e) **establish** safety plans for more routine systems in relatively low-risk environments.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers should **possess** a) significant experience on a mishap investigation or failure review board, and b) a leadership role in flight safety review process and preparation, review, or approval of project safety and quality management plans.

They must be **able to** describe, identify or define the following:

- The requirements for project life-cycle systems safety
- Processes for evaluating the adequacy of system safety analysis reports and mitigation plans

In addition, Project Managers/Project Systems Engineers are expected to a) **review** and **integrate** system safety analyses and hazard elimination/mitigation recommendations into a project risk management plan; b) **approve** hazard elimination/mitigation measures; c) **coordinate** inputs for CoFR; d) **formulate** innovative safety plans for project situations for which precedents and established plans do not exist; and e) **identify** innovative safety reporting methodology.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be *able to* direct others in applying procedures for implementing system safety findings into program and project planning.

They are also expected to a) *review* and *approve* program system safety plans; b) *approve* most critical hazard elimination/mitigation measures; c) *lead* a mishap investigation or failure review board; d) *play* leadership role in flight safety review process and preparation, review, or approval of project safety and quality management plans; e) *ensure* that projects meet CoFR requirements; and f) *develop* safety plans for complex systems in challenging environments and severe consequences of failure.

C 3.3 Safety and Mission Assurance

Safety and Mission Assurance underscores the need to implement activities associated with assuring the safety of personnel, property, and success of the project. These activities include environmental impact statements; hazards analyses, elimination, and mitigation; mishap investigations; failure review boards; the flight safety review process; and safety mission assurance, as well as the risk management plan. Depending upon the role of the individual, the proficiency levels achieved in this sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members should *understand* and *comply with* NASA safety and mission assurance strategies, policies, and standards.

They must *participate in* the following:

- Identifying the relevant safety regulations/procedures and assessing potential hazards for a subsystem
- Performing system safety analysis, verifying system safety, and conducting failure resolution and reporting
- Identifying mission assurance requirements

They are also asked to be *aware of* safety management activities that relate to assigned activities and the subsystem as well as be *able to* follow the safety and mission assurance plan as it relates to activities for a subsystem. Finally, they are asked to *contribute to* a) the safety and mission assurance readiness review; b) the program audit and review process; and c) the CoFR process.

Subsystem Lead/Small Project Manager

Subsystem Lead/Small Project Managers must have the ability to *manage* the safety planning and implementation for a simple project or subsystem with respect to the following:

- Identify relevant safety regulations/procedures
- Assess potential hazards
- Monitor and control, eliminate, or reduce identified hazards
- Perform subsystem safety analysis
- Verify subsystem safety
- Conduct failure resolution and reporting

They are also expected to **identify and manage** the test safety for the subsystem, operations safety for the subsystem, and the industrial safety as well as **identify** the mission assurance requirements for a subsystem. **Development** of the plan for the subsystem, which includes system quality, reliability and maintainability that complies with NASA safety and mission assurance strategies, policies, and standards and implementation strategies is also key to this competency area.

Finally, such individuals are asked to **contribute** to preparing for and participating in safety and mission assurance readiness reviews, the program audit and review process, and the CoFR process.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be able to **contribute to** the development of system safety planning and management policy procedures for a program and the agency. They must be able to **lead and manage** the system safety planning and implementation for a system. They are asked to **review** subsystem safety plans and implementation for the program and **employ** systems safety concepts and CRM procedures to identify and evaluate systems engineering safety threats.

Other responsibilities include: a) **identifying and managing** the test safety for the system, operations safety for the system, and industrial safety; b) **reviewing** system safety management activities and system safety and mission assurance activities for the subsystem; c) **identifying** mission assurance requirements for the system; d) **participating in** review boards for other projects and programs; e) **leading** the activities to prepare the system for and participate in safety and mission assurance readiness reviews, program audit and review processes, and CoFR processes; and f) **developing** safety and mission assurance for the plan for the system, including system quality, reliability and maintainability that complies with NASA safety and mission assurance strategies, policies, and standards and implementation strategies.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers should be **able to** establish safety planning and management policy and procedures for a program. They should also be able to a) **review** system safety plans and implementation for a program; b) **ensure** that system safety hazards within a program are identified, controlled, and/or eliminated; c) **provide**

proactive leadership to improve systems engineering safety in a program; d) **lead** the development of system safety planning and management policy and procedures for the agency; and e) **foster** a safety culture throughout the program by advocating engineering excellence.

They are also asked to **review** system safety and mission assurance activities for a program; **develop** safety and mission assurance (SMA) policy and procedures for a program or agency; **identify** mission assurance requirements for a program; **review** system safety management activities for the program; and **chair** engineering and safety review boards pertaining to SMA readiness reviews, program audit review processes, and CoFR review processes.

C 4.0 PROFESSIONAL AND LEADERSHIP DEVELOPMENT

Professional and Leadership Development encompasses activities that support the development of professional and leadership qualities among all members of the program/project team. This is accomplished through mentoring and coaching opportunities; NASA culture and functional training opportunities; oral and written communications that assure all are aware of status and decisions that affect them; recognition and reward for their personal achievements; and the example of ethical behavior and compliance with federal government policies at all times. There are four primary components to **Professional and Leadership Development**: **mentoring and coaching**, **communication**, **leadership**, and **ethics**. Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

C 4.1 Mentoring and Coaching

Mentoring and Coaching encourages the individual to act as an advisor, sponsor, or confidant who shares knowledge about NASA's functional, social, cultural, and political aspects, or provides counseling to cultivate skills in order to enhance individual, team and organizational performance and growth. Depending upon the role of the individual, the proficiency levels achieved in the **Mentoring and Coaching** sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members must be able to **secure** their own mentor to receive advice and guidance and **receive** periodic personal coaching to improve identified weaknesses.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must be willing to **receive** periodic personal coaching from a Project Manager or Systems Engineer to improve identified weaknesses. They must be able to **identify** key strengths of their team members and opportunities to develop those team members to enhance performance.

They are also expected to *serve* as a mentor to at least one team member of a subsystem team, meeting on a regular basis to provide advice and guidance; *secure* their own mentor to receive advice and guidance; and *apply* coaching skills to improve, sustain and/or enhance performance of team members for a simple project or subsystem.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be able to a) *serve* as a mentor to at least one individual and meet on a regular basis to provide advice and guidance; b) *secure* her/his own mentor and *meet* with them on a regular basis; c) *receive* periodic personal coaching from a Project Manager or Systems Engineer to improve identified weaknesses; d) *provide* guidance to enhance performance, facilitate success, and build commitment; and e) *apply* coaching skills to improve, sustain, and/or enhance performance of team members for a simple project or subsystem.

Program Manager/Project Systems Engineer

Program Managers/Project Systems Engineers must be able to *communicate* expertise, advice, and knowledge effectively for the purpose of broadening the proficiency of others to positively influence decision making and establish cooperative relationships.

They are expected to a) *serve* as a mentor to at least one individual and meet on a regular basis to provide advice and guidance; b) *advocate* for and support mentoring and coaching resources; c) *establish* a coaching and mentoring climate within the team; and e) *receive* periodic personal coaching from an administrative coach or mentor to improve identified weaknesses.

C 4.2 Communication

Communication focuses on the ability to implement strategies for clear and constructive communication—both internally within the project team and externally to stakeholders, technical experts, contractors and others. Competency in this area includes communicating decisions in a timely manner. Depending upon the role of the individual, the proficiency levels achieved in the *Communication* sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members must be able to *develop* their own ability to effectively write and present information, as well as communicate technical decisions. They are also expected to *develop* the ability to write and present reports that communicate status, challenges, problem solutions, and/or accomplishments. Finally, they are asked to *demonstrate skills in* informal and formal speaking and writing for understanding and listening for understanding.

Subsystem Lead/Small Project Manager

Subsystem Lead/Small Project Managers must be able to *demonstrate* skills (oral and written) in both formal and informal communications about technical status, challenges, problem solutions, and/or accomplishments for a subsystem. They must be able to *effectively and concisely* communicate project and technical information to provide a comprehensive and concise recommendation and *review* reports of others to ensure quality and accurate reporting of technical information.

Subsystem Leads/Small Project Managers are also expected to a) ***write and present*** reports that effectively communicate technical status, challenges, problem solutions, and/or accomplishments for a subsystem in order to provide a comprehensive account of a particular phenomenon; b) ***design, schedule*** and ***facilitate*** effective team meetings to reduce errors and/or redundancies; c) ***communicate*** the results of a technical assessment, analysis, review, and/or investigation; d) ***apply appropriate skills*** for using a variety of media to effectively communicate information about a system; e) ***promote communication approaches*** that establish an open and positive environment within a subsystem's team; and f) ***model and encourage*** listening skills that include involving, responding, and appreciating behaviors.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineer must be able to ***write and present*** project and technical information as well as communicate decisions relating to the systems project and technical activities. They must also be able to ***lead and manage*** the communication of information and decisions relating to the system's technical activities; ***communicate*** effectively and concisely project and technical information to provide a comprehensive and concise recommendation to top management; ***write and present*** reports that effectively communicate project/technical status, challenges, problem solutions, and/or accomplishments for a system in order to provide a comprehensive account of a particular phenomenon; ***lead and manage*** the writing and presenting of technical reports that effectively and concisely communicate the results of a technical assessment, analysis, and/or investigation; and ***provide*** evidence-based recommendations.

In addition to these responsibilities, such individuals must also be able to ***review*** the reports of subsystem leads to ensure quality and accurate reporting of information; ***communicate*** information from a variety of data sources that is targeted to a particular audience and provides an evidence-based and comprehensive account of a phenomenon concerning systems engineering issues related to a system; ***apply appropriate skills*** for using a variety of media to effectively communicate technical information about a system; ***promote communication approaches*** that establish an open and positive environment within a system's team; and ***create*** an environment in the team of a system that encourages listening, involving, responding, and appreciating behaviors.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be able to ***write and present*** technical information to center and HQ management, as well as communicate decisions, relating to program activities. They are responsible for ***establishing*** processes and procedures to communicate information and decisions relating to program activities and ***establishing*** processes and procedures to communicate information and decisions relating to program activities.

They are expected to a) ***write and present*** reports to center and HQ management that effectively communicate program status, challenges, problem solutions and/or accomplishments for a program; b) ***communicate*** the results of a technical assessment, analysis, and/or investigation that is targeted to a particular audience and provides a

comprehensive account of engineering issues, as well as evidence-based recommendations; c) **create** an environment that facilitates positive communication approaches within the technical workforce of a program; and d) **communicate and advocate** information regarding technical information to high levels of government and public media.

C 4.3 Leadership

Leadership assesses an individual's capacity to a) influence, inspire, and motivate individuals and teams to accomplish goals; b) create conditions in which individuals and teams can be effective; and c) recognize and reward individual and team achievements. Depending upon the role of the individual, the proficiency levels achieved in the **Leadership** sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineers/Project Team Members should **understand** leadership techniques by focusing on strategies for personal and team professional growth and their own tasks/work assignments and performance success criteria. They should also understand the power of influence, motivation, vision, and resolve, as well as the relationship between leading and managing.

They are also expected to a) **track and manage** their own performance to ensure achievement of success criteria and **participate** in a team's decision-making and problem-solving activities. **Maintaining** a collaborative and open work environment and **understanding and following** the team's decision-making and problem-solving processes are also central to proficiency in this competency area.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must be **able to** do the following:

- **Assign, delegate, and reassess** the technical tasks/work assignments
- **Implement** success criteria for performing tasks/work assignments
- **Track and manage** success criteria for performance
- **Provide** vision, direction, and guidance for project and technical activities
- **Motivate and inspire** members of the subsystem's team to perform tasks/work assignments successfully
- **Recognize** and reward the accomplishments of members of the subsystem's team
- **Establish and maintain** a collaborative and open work environment within the subsystem's team

They are also asked to **manage and lead** a subsystem's team's decision-making and problem-solving processes and **evaluate and select** among alternative approaches, concepts, architectures, etc., for a subsystem or small simple project.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be **able to** do the following for a system:

- **Assign, delegate, and reassess** the technical tasks/work assignments
- **Implement** success criteria for performing tasks/work assignments
- **Track and manage** success criteria for performance
- **Provide** vision, direction, and guidance for project and technical activities
- **Motivate and inspire** members of the subsystem's team to perform tasks/work assignments successfully
- **Recognize** and reward the accomplishments of members of the subsystem's team
- **Establish and maintain** a collaborative and open work environment within the subsystem's team

They are also expected to **contribute to** defining the success criteria for performing project/technical tasks or work assignments for a system; **employ** leadership techniques that encourage individual empowerment and guides individuals toward the successful obtainment of their goals; **lead** the system's team in decision-making and problem-solving activities; and finally, **employ** team decision-making techniques that foster consensus building, while allowing for minority opinions, and resulting in evidence-based decisions.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be able to **develop** tasks/work assignments for the leadership team for a program. They are also asked to **define** success criteria for performing technical tasks/work assignments for a program; **conduct** trend analyses of significant trends and/or anomalies concerning program/technical performance and develop proactive recommendations for the program; and **provide** vision, direction, and guidance for project/technical activities as they relate to a program.

These individuals are also asked to be able to **employ** empowerment strategies to initiate ideas and actions from other team members and leaders that foster technical innovations to support mission success. **Communicating** expertise, advice, and knowledge effectively for the purpose of broadening the proficiency of others, positively influencing decision making, and establishing cooperative relationships is also central to demonstrating proficiency in this sub-competency.

Other essential traits are the ability to **establish and maintain** an environment within the program's project/technical workforce that promotes motivation, positive recognition, and collaboration; **establish** the technical workforce decision-making and problem-solving processes for technical activities for a program; **create** an environment that encourages consensus building, as well as minority opinions, and results in decisions that are based on sound evidence; and **employ** analytical decision-making tools and knowledge within a systematic framework to make effective evidence-based decisions.

C 4.4 Ethics

Ethics emphasizes the need for each individual to demonstrate integrity, ethical conduct, and acceptable behavior in all project activities in line with federal government

principles. Depending upon the role of the individual, the proficiency levels achieved in the *Ethics* sub-competency are as follows:

Project Team Member

Project Team Members should *understand* ethical conduct and service principles in the federal government. In addition, they must *demonstrate* the following ethical practices:

- Always tell the truth, whether delivering good news or bad
- Show consistency among principles, practices, and behaviors; honor commitments and promises so that actions match words
- Behave in a fair and ethical manner; create a culture that fosters high standards of ethics; take immediate action if he or she observes unethical behavior
- Accept responsibility for actions and admit mistakes

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must *follow* federal government ethical conduct and service principles in all project activities.

Project Manager/Project Systems Engineers

Project Managers/Project Systems Engineers must *demonstrate* integrity and ethical performance in all project activity.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must *create* a culture of integrity and ethical performance for all project activity.

C 5.0 KNOWLEDGE MANAGEMENT

Knowledge Management encompasses the skills required to capture, document, and share lessons learned and best practices in an organized fashion to reduce risk and improve performance on future programs/projects through the use of NASA processes and systems. There are two primary components to **Knowledge Management**: *knowledge capture and transfer* and *knowledge sharing*. Individuals demonstrating competency in this area should be accomplished in each of these disciplines. However, the specific expression of their proficiency varies depending upon their role.

C 5.1 Knowledge Capture and Transfer

Knowledge Capture and Transfer focuses on identifying, capturing, evaluating, and transferring knowledge in an organized fashion to improve performance and reduce risk associated with future programs, systems, and projects. Depending upon the role of the individual, the proficiency levels achieved in the *Knowledge Capture and Transfer* sub-competency are as follows:

Technical Engineer/Project Team Member

Technical Engineer/Project Team Members must be able to **contribute to** the team's capture of work products and be **aware** of the following:

- Lessons learned/best practices from previous programs, projects, and significant studies
- Access to work products by appropriate users

They are required to **use** NASA's lessons learned information system (LLIS) and other agency and center knowledge management resources to enhance project performance, and to **contribute** to project team's lessons-learned activities.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must be able to **provide** access to the work products of a subsystem to appropriate users. They are also expected to a) **manage** the identification and documentation of project management and systems engineering activities, including their impact on project history and lessons learned; b) **capture** appropriate knowledge and trends relating to project management and engineering issues within the subsystem in order to input into a knowledge management system; c) **evaluate** lessons learned/best practices from previous programs, projects and significant studies; and d) **manage** the capture of work products, including decision(s) made, supporting rationale and assumptions, and any corrective actions necessary for a subsystem or simple project.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineer must be able to **manage and integrate** the identification and documentation of project management and systems engineering activities, including their impact on project history and lessons learned. They are also expected to a) **evaluate** lessons learned/best practices from previous programs, projects, and significant studies; b) **develop** lessons learned case studies based on NASA engineering experiences that can benefit the agency and junior engineers; c) **manage** the capture of work products including decision(s) made, supporting rationale and assumptions, and any corrective actions; and d) **provide** access to the work products of a system to appropriate users.

Finally, they are expected to **implement** proper knowledge management strategies that provide integration of technical knowledge and information from reports, trend analyses, and lessons learned into a knowledge management system that will enable proactive information use, assist in problem solving, and improve decision making.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be able to **promote and require** the effective application of lessons learned/best practices from previous programs, projects, and significant studies. They are also expected to a) **lead** the identification and documentation of project management and systems engineering activities, including their

impact on project history and lessons learned; b) **establish** proper knowledge management strategies that will facilitate communication, enable proactive information use, improve/enhance decision making, expedite best practices in engineering, and transfer lessons learned; c) **coordinate** the development and maintenance of project management and engineering knowledge management systems that are useful for improving decision making, information sharing, and resolving engineering issues.

Other responsibilities include **establishing processes** for the capture of and access to work products, including decision(s) made, supporting rationale and assumptions, and any corrective actions as well as **establishing policy and processes** for the agency concerning the capture of and access to work products as they pertain to a program.

C 5.2 Knowledge Sharing

Knowledge Sharing is concerned with sharing organizational practices and approaches related to generating, capturing, and disseminating know-how and other content relevant to NASA's business and processes. Depending upon the role of the individual, the proficiency levels achieved in the **Knowledge Sharing** sub-competency are as follows:

Technical Engineer/Project Team Member

Project Team Members must be **able to** describe, identify or define the following:

- Distinctions between:
 - Knowledge sharing and knowledge management
 - Tacit and explicit knowledge
- Agency and center practices and resources for capturing and sharing tacit knowledge
- The value and application of lessons learned/best practices
- The importance of sharing knowledge through story telling and the reflective practitioner concept
- NASA knowledge sharing forums and workshops

They are expected to a) **use** APPEL's online knowledge sharing resources (e.g., *ASK Magazine*, *ASK the Academy*, case studies, video archive of knowledge sharing events); b) **participate** in, and contribute to, the center's project knowledge sharing forums and activities (papers, conferences, etc.) associated with one's technical expertise; and c) **share** technical expertise and project experience with team members.

Subsystem Lead/Small Project Manager

Subsystem Leads/Small Project Managers must be **able to** describe, identify or define the following:

- How to design and facilitate a team-based knowledge sharing forum/activity
- Agency and center resources available to support knowledge sharing activity

They should also a) **demonstrate** knowledge of pertinent lessons learned/best practices; b) **participate** in knowledge sharing activities; c) **design** and **facilitate**, at minimum, two knowledge sharing forums for the Project Team Members; and d) **present** lessons-learned experiences at center-based knowledge sharing forums.

Project Manager/Project Systems Engineer

Project Managers/Project Systems Engineers must be *able to* describe, identify or define the following:

- How, when and where to create and apply knowledge sharing activities to enhance project performance
- Procedures for contributing and sharing a project's tacit knowledge with other center and agency projects

Project Managers must also exhibit the appropriate skill level by a) *providing* examples of knowledge, use and contributions of pertinent lessons learned/best practices; b) *encouraging* the team to apply knowledge sharing principles to foster a learning environment; and c) *contributing* to NASA's knowledge sharing activities. This last requirement can be met, for example, by designing and presenting at a knowledge-sharing forum for subsystem/element lead team members throughout the project, or by participating in a Masters Forum or PM Challenge event.

Program Manager/Program Systems Engineer

Program Managers/Program Systems Engineers must be *able to* describe, identify or define agency knowledge sharing requirements, resources and activities. They are also required to *provide* leadership in creating a culture of knowledge capture and the application of lessons learned/best practices.